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Iowa's Water Quality Standards
Work Element Report – Aquatic Life Criteria

I. Introduction

Determination and Analysis of the Need for Site-Specific Aquatic Life Criteria

Under the Clean Water Act, states and authorized tribes are to establish water quality criteria to protect designated uses. As stated in the EPA criteria documents, while the 304(a) criterion constitutes the EPA scientific recommendations, it does not substitute for the CWA or U.S. EPA's regulations; nor is it a regulation itself. Thus, it cannot impose legally binding requirements on the U.S. EPA, States, Tribes or the regulated community, and might not apply to a particular situation based upon the circumstances. State and Tribal decision-makers retain the discretion to adopt approaches on a case-by-case basis that differ from the 304(a) criteria when appropriate. Also, the Federal water quality standards regulation at section 131.11(b)(1)(ii) provides States with the opportunity to adopt water quality criteria that are "…modified to reflect site-specific conditions." As the EPA guidelines for the derivation of national criteria (1985b) point out "criteria produced by these Guidelines are intended to be useful for developing water quality standards, mixing zone standards, effluent limitations, etc. The development of such standards and limitations, however, might have to take into account such additional factors as social, legal, economic, and hydrological considerations, the environmental and analytical chemistry of the material, and the extrapolation from Laboratory data to field situations, and relationships between species for which data are available and species in the body of water of concern. As an intermediate step in the development of standards, it might be desirable to derive site-specific criteria by modification of national criteria to reflect such local conditions as water quality, temperature, or ecologically important species."

The ambient monitoring data shows Iowa streams have unique characteristics in physical, chemical and geological aspects. For example, Iowa tends to have hard waters in certain regions. Iowa also has organic rich soils. The original land form of Iowa has been altered to a large degree for agricultural production. Many Iowa waterways are channelized, and the SALMONIDAE family is not present in Iowa warm water streams.

Based on physical, habitat and biota differences, Iowa waters are classified into three different subcategories for aquatic life uses, cold water streams, warm water streams, and lakes and wetlands. The warm water streams are further divided into three different designations, Class B(WW-1), B(WW-2) and B(WW-3) uses are defined in Chapter 61.3(1)b as follows:

Warm water – Type 1 (Class "B(WW-1)"). Waters in which temperature, flow and other habitat characteristics are suitable to maintain warm water game fish populations along with a resident aquatic community that includes a variety of native fish and invertebrate species. These waters generally include border rivers, large interior rivers, and the lower segments of medium-size tributary streams.

Warm water – Type 2 (Class "B(WW-2)"). Waters in which flow or other physical characteristics are capable of supporting a resident aquatic community that includes a variety of native non-game fish and invertebrate species. The flow and other physical characteristics limit the maintenance of warm water game fish populations. These waters generally consist of small

perennially flowing streams.

Warm water (Class "B(WW-3)"). Waters in which flow persists during periods when antecedent soil moisture and ground water discharge levels are adequate; however, aquatic habitat typically consists of non-flowing pools during dry periods of the year. These waters generally include small streams of marginally perennial aquatic habitat status. Such waters support a limited variety of native fish and invertebrate species that are adapted to survive in relatively harsh aquatic conditions.

As stated in the definition, the Class B(WW-1) designation includes large rivers and interior streams. These rivers may contain backwater areas conducive to a Cladocera population. The flow conditions and available habitat in Class B(WW-1) designated streams support warm water game fish populations.

On the other hand, Class B(WW-2) and Class B(WW-3) designations include small wadable streams and some of the Class B(WW-2) streams contain only effluent flows from wastewater treatment plants during low flow conditions. The flow conditions and available habitat in Class B(WW-2) and Class B(WW-3) streams are unable to support game fish populations and are often dominated by the minnow type of fish species. As described in Appendix A, the Zooplankton populations in these stream conditions are dominated by rotifers. These streams do not provide sufficient hydrological retention in time and space to sustain many if any viable populations of microcrustaceans but they are adequate to sustain growth of rotifer populations. This is consistent with conclusions of several scientists that rotifers require shorter water retention times in rivers for somatic and reproductive growth than do microcrustaceans (Pace et al., 1992; Kobayashi, 1997). Also, high turbidity conditions (that may be prevalent in many Iowa streams because of agricultural runoff) could reduce population growth rates of Cladocera much more than it affects rotifers.

The EPA guidelines for the derivation of national criteria (1985b) state "The two factors that will probably cause the most difference between national and site-specific criteria are the species that will be exposed and the characteristics of the water. In order to ensure that national criteria are appropriately protective, the required data for national criteria include some species that are sensitive to many materials and national criteria are specifically based on tests conducted in water relatively low in particulate matter and organic matter. Thus, the two factors that will usually be considered in the derivation of site-specific criteria from national criteria are used to help ensure that national criteria are appropriately protective." Thus, the national dataset may contain aquatic species that are sensitive to many pollutants, but these and comparably sensitive species might not occur in Iowa streams.

The literature and data search conducted by IDNR staff indicates that the resident species in different designations of Iowa waterbodies are different than that in the national criteria document. The range for species in the Iowa warm water streams, and the variation in physical and/or chemical characteristics (such as hardness, channelization) affect the biological availability and/or toxicity of the pollutants of interest.

In order to attain the state water quality standards for Iowa waters and take into account the specific local conditions, there is a need to develop site-specific criteria for Iowa's surface waters. The site specific criteria will be developed for Iowa's three different warm water designations since the aquatic life species occurring at each stream designation are different.

The site is defined as the state. Thus, these site specific criteria would apply statewide in Iowa for each designation.

Based on the EPA WQS Handbook (US EPA, 1994), three procedures to derive site-specific criteria are recommended.

(1) The Recalculation Procedure: is intended to take into account relevant differences between the sensitivities of the aquatic organisms in the national dataset and the sensitivities of organisms that occur at the site.
(2) The Water-Effect Ratio Procedure: provided for the use of a water-effect ratio (WER) that is intended to take into account relevant differences between the toxicities of the chemical in laboratory dilution water and in site water.
(3) The Resident Species Procedure: is intended to take into account both kinds of differences simultaneously.

Based on the differences in resident species and physical/chemical characteristics in Iowa surface waters, the Resident Species Procedure (method #3) may be used. However, because the Water-Effect Ratio Procedure needs comprehensive toxicity test data on different species for a pollutant using both laboratory dilution water and site water (ambient water), it makes the Water-Effect Ratio Procedure and the Resident Species Procedure impractical to use for most states. Method #1 – Recalculation Procedure is predominantly a desk top procedure that can be conducted on any level of geographical detail. The Recalculation Procedure is used to develop site specific criteria in this report. The following chemicals are included for the criteria recalculations: Arsenic, Cadmium, Chromium III, Chromium VI, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc, Cyanide, Pentachlorophenol, Aldrin, Chlordane, 4-4'-DDT, alpha-Endosulfan, beta-Endosulfan, Endrin, Heptachlor, Heptachlor Epoxide, Polychlorinated Biphenyls (PCBs), Toxaphene, Aluminum, and Chlorine.

II. Justification for Species Deletion

As a general rule, the site specific criteria development followed the Recalculation Procedure described in the EPA WQS Handbook (1994). US EPA WQS Handbook (1994) defines the phrase "occur at the site" as including the species, genera, families, orders, classes, and phyla that:

a. are usually present,
b. are present at the site only seasonally due to migration,
c. are present intermittently because they periodically return to or extend their ranges into the site,
d. were present at the site in the past, are not currently present at the site due to degraded conditions, and are expected to return to the site when conditions improve,
e. are present in nearby bodies of water, are not currently present at the site due to degraded conditions, and are expected to be present at the site when conditions improve.

The recalculation process follows this definition when deciding which species are included in the criteria recalculation for each chemical. A resident species means the species "occur at the site" as defined above. As pointed out in the EPA WQS Handbook (1994), comprehensive information must be available concerning what species occur at the site. To meet this goal, a thorough literature and data search on resident species in Iowa waters was conducted for the

development of site specific criteria. The following data were used in the justification of species deletion.

(1). Literature review on Cladocera (Appendix A)
(2). IDNR bioassessment data on fish and invertebrates (1994-2004) (Attachment 1)
(3). Fish and invertebrates taxa found in the CPCB's USEPA Region 7 fish database (Attachment 2)
(4). Iowa Total Species List compiled by IDNR in 2000 (Attachment 3)
(5). Iowa State University Lakes Study data on Zooplankton (2000-2005) (Attachment 4)
(6). Iowa Department of Natural Resources (IDNR) Education web page. 2006. URL: http://www.iowadnr.gov/education/cdfiles.html
(7). Iowa Rivers Information system: Aquatic GAP Predicted Species Map. URL:http://maps.gis.iastate.edu/msiris/predicted/
(8). Expert opinions (see Appendix A for expert names)
(9). Iowa Department of Natural Resources, 1987. Iowa Fish and Fishing. Des Moines, IA 50319.

For a specific pollutant, a step-wise process was used to decide which species toxicity data in the national database are included in the criteria recalculation based on the above data sources. If a species in the 304(a) criteria database is decided to occur at the site (or the stream designation of interest in Iowa), the species is retained. Some species may be present occasionally in certain designated streams, but they may not be a resident species since the habitat and physical conditions may not be suitable to sustain a viable population and reproduction. If the species does not occur, and a different species in the same genus occurs at the site but are not in the dataset, the species is retained. If the same genus does not occur at the site, and a different genus in the family occurs at the site but is not in the dataset, the species is retained. If the family does not occur at the site, but the order occurs at the site, the species is retained if the dataset does not contain a species in the same order; otherwise, the species is deleted. This process is applied to each species in the national toxicity dataset for each chemical when the criterion is recalculated for that chemical. The following step-wise process to determine which of the species must be deleted and which must not be deleted in the national dataset as described in the WQS Handbook (1994) is found below:

Step a: Retain and circle each species that satisfies the definition of "occur at the site" and including any data for species that are surrogates of threatened or endangered species that occur at the site.

Note: For Iowa site specific criteria calculation, Rainbow Trout is used as the surrogate species for Topeka Shiner. Thus, it is retained for each designation.

For the species that are not resident species (or occur at the site) for a designation, the following steps are followed.

1. Does the genus occur at the site?
   If "No," go to Step 2.
   If "Yes," are there one or more species in the genus that occur at the site but are not in the dataset?
   If "No," go to Step 2
   If "Yes," retain the uncircled species.*

2. Does the family occur at the site?
   If "No," go to Step 3.
   If "Yes," are there one or more genera in the family that occur at the site but are not in the dataset?
      If "No," go to Step 3
      If "Yes," retain the uncircled species.*

3. Does the order occur at the site?
   If "No," go to Step 4.
   If "Yes," does the dataset contain a circled species that is in the same order?
      If "No," retain the uncircled species*
      If "Yes," delete the uncircled species.*

4. Does the class occur at the site?
   If "No," go to Step5.
   If "Yes," does the dataset contain a circled species that is in the same class?
      If "No," retain the uncircled species*
      If "Yes," delete the uncircled species.*

5. Does the phylum occur at the site?
   If "No," delete the uncircled species.*.
   If "Yes," does the dataset contain a circled species that is in the same phylum?
      If "No," retain the uncircled species*
      If "Yes," delete the uncircled species.*

* = Continue the deletion process by starting at Step 1 for another uncircled species unless all uncircled species in the dataset have been considered.

For each chemical, the above deletion steps are followed using the available data and literature search to determine which species should be retained in the recalculation. It is important to point out that if a species is deleted from the toxicity dataset; it does not mean that the recalculated criterion is not protective of that species and its genus. Two main factors affect the recalculated criteria values, the toxicity values (LC50 values) for the four most sensitive species and the number of species in the final dataset. The recalculated criteria values would be lower if the toxicity values for the four most sensitive species were reduced. The recalculated criteria values would be lower if the number of species included in the recalculation is reduced. For example, if the toxicity data for Guppy is deleted from the dataset, the recalculated criterion value will be lower than the derived criteria including Guppy toxicity data since Guppy is not the most sensitive species. Even though Guppy is deleted from the dataset, the recalculated criterion is still protective of Guppy species since the criterion is derived based on the four most sensitive species that have lower toxicity data than Guppy. Also, the eight family rule for the recalculation ensure that different species and genus are represented in the criteria recalculation. Species from the following eight families are to be included to derive site-specific criteria (US EPA, 1985b):

1. The family Salmonidae in the class Osteichthyes (Phylum Chlordata)

2. A second family in the class Osteichthyes, preferably a commercially or recreationally important warm water species (e.g., bluegill, channel catfish, etc.)

3. A third family in the phylum Chordata (may be in the class Osteichthyes or may be an amphibian, etc.)

4. A planktonic crustacean (e.g., cladoceran, copepod, etc.)

5. A benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish, etc.)

6. An insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge, etc.)

7. A family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca, etc.)

8. A family in any order of insect or any phylum not already represented

(Large to small: Kingdom, Phylum, Class, Order, Family, Genus, Species)

As stated in the 304 (a) criteria document for Cadmium (US EPA, 2001), acute toxicity test data must be available for species from a minimum of eight diverse taxonomic groups. The diversity of tested species is intended to assure protection of various components of an aquatic ecosystem. Based on EPA national guidelines (US EPA, 1985b), the protection of zooplankton assemblages are only necessary for lakes, reservoirs. The EPA national guideline (US EPA, 1985b) states "To be acceptable to the public and useful in field situations, protection of aquatic organisms and their uses should be defined as prevention of unacceptable long-term and short-term effects on (1) commercially, recreationally, and other important species and (2) (a) fish and benthic invertebrate assemblages in rivers and streams, and (b) fish, benthic invertebrates, and zooplankton assemblages in lakes, reservoirs, estuaries, and oceans." IDNR conducted additional measures to ensure the recalculated criteria are protective of the resident species in Iowa' designated warm waters. The research conducted by IDNR staff indicates that Rotifers are the dominant zooplankton in Iowa's stream environment. It is obvious that the eight family rule guarantees the Rotifer family is represented in the toxicity database for the development of site specific criteria. Also, Daphnia spp. are kept for all three designations, Class B(WW-1), B(WW-2) and B(WW-3), even though Cladoceran is not a main diet of Topeka Shiner based on the current studies. Thus, the toxicity test data used in the criteria recalculations are not only protective of various components of a warm water stream ecosystem but also are protective of the Topeka Shiner's diet.

III. Endangered Species Act (ESA) Consultation Requirement

The USFW Endangered Species Act (ESA, 1973) Section 7 directs all Federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the Service, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. Section 7 of the Endangered Species Act requires all Federal agencies, in consultation with the Fish and Wildlife Service and the National Marine Fisheries Service (the Services) to assure that any action authorized, funded, or implemented by a Federal agency does not jeopardize the existence of endangered or threatened species or result in the destruction or adverse modification of their critical habitat. The responsibility for ensuring that consultation occurs with the Services lies with EPA, although in fulfilling the requirements a non-Federal representative may be designated for informal consultation. Consultation may be formal or informal; the latter form is the most prevalent (WQS Handbook, 1994).

Based on the discussions with Mike Coffey, USFW on 10/19/2006 and 11/2/2006, the following endangered species for each of the relevant designations should be protected.

Aquatic life species:
Scaleshell Mussel (*Leptodea leptodon*), Higgins Eye Pearlymussel, Sheepnose Mussel, the Spectaclecase Mussel - Class B(WW-1) streams
Shiner, Topeka (*Notropis topeka*) – B(WW-2) and B(WW-3) streams
Sturgeon, Pallid (*Scaphirhynchus albus*) – only Missouri River

Aquatic life dependent species:
Tern, Least (*Sterna antillarum*) – B(WW-1), B(LW) & reservoir
Plover, Piping – B(WW-1), B(LW) & reservoir
Eagle, Bald (*Haliaeetus leucocephalus*) - B(WW-1), B(LW) and B(WW-2) not B(WW-3)
Indiana Bat – Southern half states – B(WW-1), B(WW-2), and B(WW-3) (they only eat insects)
Massasauga Rattlesnake – Wetlands

To ensure the recalculated criteria are protective of these endangered species a justification is made for each chemical. For the aquatic life species, either 304(a) criteria are proposed or a surrogate species is used. If 304(a) criteria are proposed, the consultation is deferred to the national level based on the Memorandum of Agreement between U.S. Fish and Wildlife Service and the U.S. EPA. Also, a new toxicity data search is conducted for the endangered species and the relevant chemicals. To protect Topeka Shiner, Rainbow Trout is used as the surrogate species in most cases. Based on the current available toxicity test data on some of the endangered species (US EPA, 1995), after 96-hour of exposure, warm water listed species were more sensitive than the fathead minnow 33% of the time. However, the listed warm water species were always less sensitive than the Rainbow Trout. The use of Rainbow Trout as the surrogate species for Topeka Shiner has been determined to be adequately protective. In certain cases, a species in the same family as the endangered species may be used as the surrogate species instead of the Rainbow Trout. For bioaccumulative chemicals such as Chlordane, 4-4'-DDT, Heptachlor and Heptachlor Epoxide, Toxaphene, PCB's (legacy/banned pesticides), the Final Residue Value for protecting fish marketability or wildlife are proposed as the chronic criterion for aquatic life protection in order to ensure the aquatic dependent endangered species are protected since there is no wildlife criteria available at this time. For each non-bioaccumulative chemical, if the recalculated criteria are demonstrated to be protective of aquatic life species (including the aquatic endangered species), they should also be protective of aquatic life dependent species since these chemicals do not usually accumulate in fish or invertebrate tissues.

IV. Margin of Safety Incorporated into the Criteria Recalculation and Implementation

As stated in the National Guidelines (US EPA, 1985a), "Because aquatic ecosystems can tolerate some stress and occasional adverse effects, protection of all species at all times and places is not deemed necessary…" However, to ensure reasonable protection of the site specific criteria is achieved for Iowa's designated warm water streams, several safety factors are incorporated into the development of the recalculated criteria and their implementation.

(1) Conservatism factor for dilution water: toxicity tests used in the national dataset are mainly conducted using reconstituted lab water. Some studies have shown that the toxicity for many pollutants may be mitigated in the ambient environment because of higher particulate matter, organic matter and other ions.

(2) Conservatism factor for total metal criteria: the 304(a) criteria are expressed as the dissolved form for metals criteria. Iowa's recalculated criteria for metals are total recoverable concentrations, which has a conservatism factor associated with it since most of the particulate forms of metals are not bioavailable in the ambient environment. As stated in the 304(a) criteria document for Cadmium (US EPA, 2001, page 34), "The use of dissolved criteria reduces the amount of conservatism that was present in earlier cadmium criteria. It is recognized that a considerable proportion of dissolved cadmium in organic-rich waters may be less toxic than freely dissolved cadmium."

(3) Conservatism factor in averaging period: averaging period for criteria implementation is much shorter than the length of the toxicity tests used to derive the criteria. For example, the length of the acute toxicity tests is usually 48 to 96 hours. The duration of the averaging periods for the acute criteria application is one-hour. The length of the chronic toxicity tests usually last 20 to 30 days. The subchronic toxicity tests could last 7 days. The duration of the averaging periods for chronic criteria application is 4 days for metals. The duration of the averaging periods for the acute and chronic criteria implementation is made short enough to restrict allowable fluctuations in the concentration of the pollutant in the receiving water and to restrict the length of time that the concentration in the receiving water can be continuously above a criterion concentration.

(4) Conservatism in stream design flows: the implementation of the criteria for deriving water quality based limits usually rely on steady state models, in which EPA recommends the use of 1Q5 or 1Q10 for acute criteria stream design flow and 7Q5 or 7Q10 for the chronic design flow for unstressed systems and stressed systems respectively. IDNR applies 1Q10 (lower than 1Q5) and 7Q10 (lower than 7Q5) stream flows for deriving water quality based limits. Two conservatism factors are built in the process. One conservatism factor is that the discharge rarely occurs at the stream critical low flows. Also, many 1Q10 and 7Q10 stream flows are zero for Class B(WW-2) and B(WW-3) designated streams. Another conservatism factor is that IDNR applies 1Q10 and 7Q10 instead of 1Q5 and 7Q5 by assuming the stream conditions are already stressed by the pollutant.

(5) Conservatism factors in protecting the endangered species: Conservatism factor for using Rainbow Trout as the surrogate species for Topeka Shiner: Topeka Shiner is a warm water species that belongs to the same minnow family as the Fathead Minnow. At present, the Fathead Minnow is considered to be an acceptable surrogate for warm water fishes. Similarly, the Rainbow Trout is considered to be an acceptable surrogate for cold water fishes based on EPA 1995 guidance on the use of surrogate species in assessing contaminant risk to endangered fishes. To be more conservative, the recalculation uses Rainbow Trout, a coldwater species, as the surrogate species for Topeka Shiner in most of the cases.

In addition, another margin of safety factor is added for the implementation of the recalculated criteria for critical habitat areas and bioaccumulative chemicals by limiting the use of the allowed mixing zones described as follows.

The use of the recommended site specific criteria in this document in designing waste treatment facilities requires selection of an appropriate wasteload allocation model. Dynamic models are preferred for application of these criteria. Limited data or other factors may make their use impractical, in which case a steady state model may be used. If a steady state model is used, then a 1Q10 stream is used for the acute criterion design flow and 7Q10 is used for chronic criteria design flow. The mixing zone policy stated in IAC 61.2(4)"b" will apply. However, the following restrictions may apply in a case by case basis.

- Mixing zones would be restricted such that they do not encroach on areas often used for harvesting of stationary species such as shellfish.
- Mixing zones and zones of initial dilution would not be appropriate for bioaccumulating pollutants, such as Mercury, Chlordane, PCB, DDT and Dieldrin.
- Mixing zones should not be located in the critical habitat for threatened or endangered species for Topeka Shiners.
- Mixing zones would not be appropriate where established mussel beds exist, for example, on the Mississippi River, mixing zones and initial dilutions should not be allowed to encroach on known mussel beds.

These margin of safety factors ensure the recalculated criteria are protective of all three warm water designated uses.

V. Criteria Recalculation for Different Chemicals

The Recalculation Procedure was used for each chemical listed below. For each criteria where it was determined to use the recalculated criteria rather than the 304(a) criteria, a justification can be found. Where 304(a) criteria were proposed, it was determined that the recalculation provided the same criteria as 304(a) or a criteria more stringent than 304(a). Because 304(a) criteria have already been determined to be adequately protective of aquatic life species and to be consistent with the Clean Water Act, it will be proposed in those cases.

For several chemicals including cadmium, copper, lead, nickel, silver and zinc, enough data are available to show that the acute and/or chronic toxicity are related to a water quality characteristic, hardness. The relationship is taken into account in the proposed criteria. For these chemicals, the proposed criteria are expressed as an exponential equation with the hardness as the independent variable. The pooled slope in the equation is derived using a least squares regression of all the (normalized) acute values on the corresponding (normalized) hardness values as described in the EPA's guidelines document (1985b). For each species, comparable acute toxicity values should be available at two or more different hardness values to perform a least square regression. If not enough data is available to derive the pooled slope for the Final Chronic Equation, the acute pooled slope is used as the chronic pooled slope in the equation. The Final Acute or Chronic Equation is written as: e^(V*ln(hardness) + b); where V is the pooled acute or chronic slope, and b is the intercept value.

The following table summarizes the proposed criteria for each chemical as a result of the recalculation.

Chemicals	B(WW-1)	ESA Issue	B(WW-2,3)	ESA Issue
Arsenic	304(a) proposed	Deference	304(a) proposed	Deference

Cadmium	Recalculated criteria proposed for acute	Justified	Recalculated criteria proposed for acute	Justified
Chromium (VI)	304(a) proposed	Deference	Recalculated criteria proposed	Justified
Copper	304(a) proposed	Deference	Recalculated criteria proposed	Justified
Lead	304(a) proposed	Deference	304(a) proposed	Deference
Mercury	304(a) proposed	Deference	Recalculated criteria proposed	Justified
Nickel	304(a) proposed	Deference	304(a) proposed	Deference
Selenium VI	304(a) proposed	Deference	304(a) proposed	Deference
Silver	304(a) proposed	Deference	304(a) proposed	Deference
Zinc	304(a) proposed	Deference	Recalculated criteria proposed	Justified
Cyanide	304(a) proposed	Deference	304(a) proposed	Deference
Pentachlorophenol	This chemical will be addressed as a cold water criteria			
Aldrin	304(a) proposed	Deference	304(a) proposed	Deference
Chlordane	304(a) proposed	Deference	304(a) proposed	Deference
4,4'-DDT	Acute: 304(a) proposed Chronic: 304(a) adopted	Deference	Acute: 304(a) proposed Chronic: 304(a) proposed	Deference
Endosulfan	304(a) proposed	Deference	304(a) proposed	Deference
Endrin	This chemical will be addressed as a cold water criteria			
Heptachlor and Heptachlor Epoxide	Acute: currently more stringent than 304(a) Chronic: 304(a) adopted	Deference	Acute: currently more stringent than 304(a) Chronic: 304(a) proposed	Deference
PCB	Acute: 304(a) proposed Chronic: 304(a) adopted	Deference	Acute: currently more stringent than 304(a) adopted Chronic: 304(a) proposed	Deference
Toxaphene	304(a) proposed	Deference	304(a) proposed	Deference
Aluminum	Recalculated criteria proposed for acute	Justified	Recalculated criteria proposed	Justified
Chlorine	304(a) proposed	Deference	304(a) proposed	Deference
Lindane	304(a) adopted	Deference	304(a) adopted	Deference
Dieldrin	304(a) adopted	Deference	304(a) adopted	Deference

The following section shows the calculations and the proposed criteria changes for each pollutant of concern. The recalculation follows the procedure described in the EPA guideline document (1985b). The Final Acute Value is calculated using the four most sensitive species Genus Mean Acute Values. In certain cases, the Final Acute Value may be lowered to protect a commercially or recreationally important species at the site. The acute criterion is calculated as one-half the Final Acute Value to prevent any acute effect. If enough chronic toxicity data to aquatic animals are available, the Final Chronic Value or the chronic criterion can be calculated in the same manner as the Final Acute Value. The chronic criterion for Cadmium is calculated this way. For the other chemicals, the Final Chronic Values are calculated by dividing the Final Acute Value by the Final Acute-Chronic Ratio for each chemical.

The proposed criteria are presented in two groups. The first group includes the chemicals that the recalculated criteria (which are different than the 304(a) criteria) are the proposed criteria. They include Cadmium, Chromium, Copper, Mercury, Zinc and Aluminum. The second group includes the rest of the chemicals for which the 304(a) criteria are proposed as the recommended criteria. It is important to note that for majority of the chemicals addressed in this report, the 304(a) criteria are recommended.

A. Chemicals for which the Recalculated Criteria are Recommended

1. Cadmium

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: The criteria recalculation was based on the 2001 update of ambient criteria for Cadmium (US EPA, 2001). There are a total of 55 genus in the acute toxicity database. The species deletion procedure is applied to both acute and chronic criteria development. The fish species Guppy and Tilapia are deleted for all three designations. Guppy is in the family of *Poeciliidae*. According to Iowa Fish and Fishing (IDNR, 1987), only one member of the *Poeciliidae* family, the Mosquitofish, is found in Iowa. It is the only resident fish species that gives birth to living young. Since Mosquitofish is already in the dataset, Guppy can be deleted from the dataset based on the recalculation procedure in the EPA WQS Handbook (US EPA, 1994). *Tilapia spp.* is not a resident species in Iowa and is deleted since the Order *Perciformes* is represented by Striped Bass. All the coldwater species except for Rainbow Trout are deleted from the dataset since they are not resident species in warm water streams.

Class B(WW-1) Acute Criterion:
All Cladocera species are retained for the Class B(WW-1) designation. In the September 11th draft version of this document, both *Alona affinia* and *Moina macrocopa* were deleted in the recalculation for Class B(WW-1). EPA Region 7 comments to IDNR on October 17, 2006 states that Dr. John Havel, Missouri State University, "have found them in samples taken from numerous reservoirs in the Great Plains (Missouri, Arkansas and Oklahoma) and the Missouri River (email correspondence 9/18/06, and journal article: John E. Havel, Shurin, J.B., and Jones, J.R. 2005. Environmental limits to a rapidly spreading exotic cladoceran. Eco science. Vol 12(3): 376-386.)." Thus, *Alona affinia* and *Moina macrocopa* species are retained for the Class B(WW-1) designation. A total of 51 genus species are used for the recalculation of the acute criterion for the Class B(WW-1) designation.

Class B(WW-1) Chronic Criterion:
Enough chronic toxicity test data are available to derive the chronic criterion using a similar procedure as used for deriving the acute criterion instead of the FACR. There are a total of 16 genus in the chronic toxicity database. For the recalculation of chronic criteria, all cold water species such as Chinook Salmon, Coho Salmon, Brook Trout, Lake Trout, Atlantic Salmon, and Brown Trout are deleted for all three designations since they are not resident species for warm waters. However, Rainbow Trout is retained to be a surrogate species for the Topeka Shiner. *Ceriodaphnia spp*. is retained for Class B(WW-1) designation based on the literature search in Appendix A. Fourteen genus species are retained in the dataset to conduct the recalculation. After species deletion, the toxicity dataset becomes too small and the recalculation procedure results in lower criteria values. Thus, the chronic 304(a) criterion is proposed for Class B(WW-1).

Class B(WW-2) & B(WW-3) Acute Criterion:
The literature search (Appendix A) indicates that the commonly found resident Cladocera species is *Bosmina spp*. in small wadable or headwater streams. Only one research paper (Brown, A. et al., 1989) found *Alona affinis* in relatively abundant numbers in the headwater of the Illinois River, Arkansas. Thus, *Alona affinis* is retained for Class B(WW-2) and B(WW-3) designations. The literature search indicates *Ceriodaphnia spp.* was not found in either of the studies in small wadable streams. *Daphnia spp.* and *Alona affinis* are retained for all three designations. Since the Order of *Cladocera* is represented by *Daphnia spp*. and *Alona affinis*, other non-resident Cladocera species are deleted from Class B(WW-2) and B(WW-3). A total of 48 species are used in the recalculation. The four most sensitive species retained in the dataset are the same as that for the Class B(WW-1) designation. However, because the number of total species used is lower than that for Class B(WW-1) recalculation, it results in a lower acute criterion for Class B(WW-2) and B(WW-3) designations than that for B(WW-1). Since the acute criterion for Class B(WW-1) protects all the species in the dataset for Class B(WW-2) and B(WW-3), the recalculated acute criterion for Class B(WW-1) is proposed for Class B(WW-2) and B(WW-3) designations.

Class B(WW-2) & B(WW-3) Chronic Criterion:
The recalculation results in more stringent criterion than 304(a) values because the toxicity dataset is too small. 304(a) chronic criterion is proposed for Class B(WW-2) & B(WW-3) designations.

The toxicity of Cadmium is hardness dependent. Iowa ambient water quality monitoring from 2000 to 2005 indicates that the median total hardness value is 300 mg/l (as CaCO3). Table 1a, 1b and 1c show the species used in the recalculation and the recommended acute and chronic criteria as a function of total hardness as CaCO3.

Table 1a. Recalculation of **Cadmium Acute** Criteria by Species Deletion

SPECIES					**Species Used in Different Stream Designations**		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
salmo	trutta	SALMONIDAE	BrownTrout	1.613			
Salvelinus	fontinalis	SALMONIDAE	BrookTrout	<1.791			
Salvelinus	confluentus	SALMONIDAE	BullTrout	2.152			
Morone	saxatilis	PERCICHTHYIDAE	Stripedbass	2.925	Yes	Yes	Yes
Oncorhynchus	tshawytscha	SALMONIDAE	chinooksalmon	4.305			

Oncorhynchus	kisutch	SALMONIDAE	cohosalmon	6.221			
Oncorhynchus	mykiss	SALMONIDAE	RainbowTrout	2.108	Yes	Yes	Yes
Ptychocheilus	lucius	CYPRINIDAE	Coloradosquawfish	22.54	Yes	Yes	Yes
Ptychocheilus	oregonensis	CYPRINIDAE	northpikeminnow	2221	Yes	Yes	Yes
Daphnia	magna	DAPHNIDAE	cladoceran	13.41	Yes	Yes	Yes
Daphnia	pulex	DAPHNIDAE	cladoceran	46.36	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fatheadminnow	29.21	Yes	Yes	Yes
simocephalus	serrulatus	DAPHNIDAE	Cladoceran	30.21	Yes		
Lampsilis	straminea claibornensis	UNIONIDAE	Mussel	47.68	Yes	Yes	Yes
Lampsilis	teres	UNIONIDAE	Mussel	23.91	Yes	Yes	Yes
Actinonaia	pectorosa	UNIONIDAE	Mussel	33.8	Yes	Yes	Yes
Vilosa	vibex	UNIONIDAE	Mussel	35.18	Yes	Yes	Yes
Lophopodella	carteri	LOPHOPODIDAE	bryozoan	35.74	Yes	Yes	Yes
Ceriodaphnia	reticulata	DAPHNIDAE	cladoceran	41.07	Yes		
Ceriodaphnia	dubia	DAPHNIDAE	cladoceran	31.37	Yes		
Xyrauchen	texanus	CYPRINIDAE	RazorbackSucker	36.62	Yes	Yes	Yes
Gila	elegans	CYPRINIDAE	Bonytil	38.72	Yes	Yes	Yes
Utterbackia	imbecilis	UNIONIDAE	Mussel	42.92	Yes	Yes	Yes
Moina	macrocopa	DAPHNIDAE	cladoceran	43.09	Yes		
Lirceus	alabamae	ASELLIDAE	isopod	48.44	Yes	Yes	Yes
Gammarus	pseudolimnaeus	GAMMARIDAE	amphipod	78.69	Yes	Yes	Yes
Physa	gyrina	PHYSIDAE	snail	100.2	Yes	Yes	Yes
Aplexa	hypnorum	PHYSIDAE	snail	103.9	Yes	Yes	Yes
Lumbriculus	variegatus	TUBIFICIDAE	worm	130.6	Yes	Yes	Yes
Pectinatella	magnifica	PECTINATELCIDAE	bryozoan	166.8	Yes	Yes	Yes
Glossiponia	complanta	ERPOBDELLIDAE	Leech	192.5	Yes	Yes	Yes
Cyclops	varicans	CYCLOPIDAE	Copepod	223.2	Yes	Yes	Yes
Alona	affinia	DAPHNIDAE	cladoceran	247.2	Yes	Yes	Yes
Plumatella	emarginata	PLUMATELLIDAE	bryozoan	259.7	Yes	Yes	Yes
Asellus	bicrenata	ASELLIDAE	isopod	472.1	yes	Yes	Yes
Ambystoma	gracile	AMBYSTOMIDAE	NorthwesternSalamander	521.4	Yes	Yes	Yes
Limnodrilus	hoffmeisteri	TUBIFICIDAE	tubificidworm	775	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	844	Yes	Yes	Yes
Tubifex	tubifex	TUBIFICIDAE	tubificidworm	1361	Yes	Yes	Yes
Xenopus	laevis	Pipidae	AfricanClawedFrog	1529	Yes	Yes	Yes
crangonyx	pseudogracilis	CRANGONIDAE	Amphipod	1700	Yes	Yes	Yes
Procambarus	clarkii	ASTACIDAE	Crayfish	1748	Yes	Yes	Yes
Ephemerella	grandis	EPHEMERELLIDAE	Mayfly	2278	Yes	Yes	Yes
Branchiura	sowerbyi	TUBIFICIDAE	tubificidworm	2350	Yes	Yes	Yes
Poecilia	reticulata	POECILIIDAE	guppy	2462			
Jordanella	floridae	CYPRINODONTIDAE	flagfish	2847	Yes	Yes	Yes
Quistradilus	multisetosus	TUBIFICIDAE	tubificidworm	3133	Yes	Yes	Yes
Catastomus	commersoni	CATOSTOMIDAE	whitesucker	3136	Yes	Yes	Yes
Varichaeta	pacifica	TUBIFICIDAE	tubificidworm	3721	Yes	Yes	Yes
Notropis	lutrenis	CYPRINIDAE	RedShiner	3837	Yes	Yes	Yes
Spirosperma	ferox	TUBIFICIDAE	tubificidworm	3427	Yes	Yes	Yes
Spirosperma	nikoiskyi	TUBIFICIDAE	tubificidworm	4406	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	Bluegill	6028	Yes	Yes	Yes
Lepomis	Cyanellus	CENTRARCHIDAE	GreenSunfish	2965	Yes	Yes	Yes

Cyprinus	carpio	CYPRINIDAE	carp	4238	Yes	Yes	Yes
Ictalurus	punctatus	ICTALURIDAE	ChannelCatfish	5055	Yes	Yes	Yes
Stylodrilus	heringianus	TUBIFICIDAE	tubificidworm	5386	Yes	Yes	Yes
Gasterosteus	aculeatus	GASTEROSTEIDAE	stickleback	5439	Yes	Yes	Yes
Rhyacodrilus	montana	TUBIFICIDAE	tubificidworm	6169	Yes	Yes	Yes
Gambusia	affinis	POECILIIDAE	mosquitofish	6499	Yes	Yes	Yes
Oreochromis	mossambica	CICHLIDAE	Tilapia	10663			
Orconectes	virilis	ASTACIDAE	Crayfish	11859	Yes	Yes	Yes
Orconectes	immunis	ASTACIDAE	Crayfish	>11509	Yes	Yes	Yes
Dendrocoelum	lacteum	PLANARIIDAE	Planarian	14067	Yes	Yes	Yes
Chironomus	riparius	CHIRONOMIDAE	midge	96880	Yes	Yes	Yes
			Number of Species, N		51	48	48
			Recalculated CMC at hardness 50 (ug/l)		9.6655	8.372	8.372
			Recalculated CMC((ug/l)		exp(1.0166Ln(hardness)-2.402)	exp(1.0166Lnhardness-2.545)	exp(1.0166Lnhardness-2.545)
			Final CMC((ug/l)		exp(1.0166Ln(hardness)-2.402)	exp(1.0166Ln(hardness)-2.402)	exp(1.0166Ln(hardness)-2.402)
			* Make the CMC for B(WW-2) and B(WW-3) equals that for B(WW-1)				

Table 1b. Recalculation of **Cadmium Chronic** Criteria by Species Deletion

SPECIES					**Species Used in Different Stream Designations**		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Hyalella	azteca	HYALELLIDAE	amphipod	0.2747	Yes	Yes	Yes
Daphnia	magna	DAPHNIDAE	cladoceran	0.3794	Yes	Yes	Yes
Daphnia	pulex	DAPHNIDAE	cladoceran	6.167	Yes	Yes	Yes
Oncorhynchus	tshawytscha	SALMONIDAE	chinook salmon	2.612			
Oncorhynchus	kisutch	SALMONIDAE	coho salmon	4.265			
Oncorhynchus	mykiss	SALMONIDAE	Rainbow Trout	1.308	Yes	Yes	Yes
Chironomus	tentans	CHIRONOMIDAE	midge	2.804	Yes	Yes	Yes
Salvelinus	fontinalis	SALMONIDAE	BrookTrout	2.643			
Salvelinus	namaycuush	SALMONIDAE	Lake Trout	8.088			
Aplexa	hypnorum	PHYSIDAE	snail	4.82	Yes	Yes	Yes
Jordanella	floridae	CYPRINODONTIDAE	flagfish	5.318	Yes	Yes	Yes
salmo	salar	SALMONIDAE	Atlantic salmon	7.922			
salmo	trutta	SALMONIDAE	BrownTrout	5.004			
Catastomus	commersoni	CATOSTOMIDAE	whitesucker	7.804	Yes	Yes	Yes
Esox	lucius	ESOCIDAE	Northern Pike	8.092	Yes	Yes	Yes
Micropterus	dolomieui	PERCICHTHYIDAE	Smallmouth bass	8.124	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fathead minnow	16.38	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	Bluegill	17.38	Yes	Yes	Yes
Aeolosoma	headleyi	AEOLOSOMATIDAE	Oligochaete	20.74	Yes	Yes	Yes
Oreochromis	aurea	CYPRINIDAE	Blue Tilapia	23.63	Yes	Yes	Yes
Ceriodaphnia	dubia	DAPHNIDAE	cladoceran	27.18	Yes		
			Number of Species, N		14	13	13
			Recalculated CCC at hardness 50 (ug/l)		0.146	0.135	0.135

			Recalculated CCC((ug/l)	exp(0.7409Ln(hardness)-4.824)	exp(0.7409Ln(hardness)-4.898)	exp(0.7409Ln(hardness)-4.898)
			Final CCC*((ug/l)	exp(0.7409Ln(hardness)-4.719)	exp(0.7409Ln(hardness)-4.719)	exp(0.7409Ln(hardness)-4.719)
			*Adopt 304(a) criteria			

Protection for Endangered Species: Two aquatic endangered species, Scaleshell Mussel and Pallid Sturgeon reside in Class B(WW-1) streams. One aquatic endangered species, Topeka Shiner, resides in Class B(WW-2) and B(WW-3) streams. In the acute criteria toxicity dataset, four mussel species are included *Lampsilis straminea claibornensis, Lampsilis teres, Actinonaia pectorosa, and Vilosa vibex*. The lowest Species Mean Acute Value is 23.91 ug/l, which is much higher than the FAV (9.665 ug/l) for the recalculated criteria at a hardness of 50 mg/l as CaCO3.

USFW scientist Mike Coffey and IDNR staff conducted a toxicity data search on glochidia and juvenile sensitivity on Cadmium toxicity. The data so far show that the juvenile mussels, especially the newly released juvenile mussels, are more sensitive than glochidia life stages. The data also show that the IDNR recalculated Final Acute Value is lower than any of the EC50 values from the Cadmium toxicity tests. In addition, personal communications with the scientist at USGS who has been conducting mussel toxicity test indicates that the glochidia life stage is less sensitive than juvenile mussels for Cadmium.

Thus, based on the above justification, IDNR concludes that the recalculated criteria for Class B(WW-1) is protective of endangered mussel species.

The ambient water quality monitoring data for 2000 – 2005 shows the 10^{th} percentile hardness value (90% of the sample values are above this hardness value) for Iowa streams is 200 mg/l as CaCO3. The recalculated criteria for Class B(WW-1) is determined to be protective of the Scaleshell Mussel. Because the Pallid Sturgeon resides in the Missouri River, the national criteria are proposed for the Missouri River (national criteria is lowered to protect important species such as the Rainbow Trout). For Class B(WW-2) and B(WW-3) streams, the Red Shiner is used as the surrogate species for Topeka Shiner since they are in the same family. The Species Mean Acute Value for the Red Shiner is 3837 ug/l, which is much higher than the CMC at hardness of 50 mg/l as CaCO3 (9.665 ug/l). Therefore, the recalculated criteria for Class B(WW-2) and Class B(WW-3) are determined to be protective of Topeka Shiner.

Table 1c. Current and Proposed IDNR Aquatic Life Criteria for **Cadmium** (total, unit in µg/l)

Criteria*	Missouri River		Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	75	exp(1.0166Ln(hardness)-3.924)	75	exp(1.0166Ln(hardness)-2.402)	100	exp(1.0166Ln(hardness)-2.402)	100	exp(1.0166Ln(hardness)-2.402)	exp(1.0166Ln(hardness)-3.924)
Chronic(CCC)	15	exp(0.7409Ln(hardness)-4.719)	15	exp(0.7409Ln(hardness)-4.719)	25	exp(0.7409Ln(hardness)-4.719)	25	exp(0.7409Ln(hardness)-4.719)	exp(0.7409Ln(hardness)-4.719)

Table 1d. Current and Proposed IDNR Aquatic Life Criteria for **Cadmium** at Hardness 100 mg/l as CaCO3 (total, unit in µg/l)

Criteria*	Missouri River		Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	75	2.13	75	9.77	100	9.77	100	9.77	2.13
Chronic(CCC)	15	0.27	15	0.27	25	0.27	25	0.27	0.27

2. Chromium (VI)

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: The recalculation is based on the 1995 Updates for Chromium (VI). A total of 28 genus species are in the national toxicity dataset. The Guppy was retained to represent Mosquitofish in the *Poeciliidae* family for all three designations. Also, Brook Trout was deleted from all three designations since it is a coldwater fish. Rainbow Trout is retained to meet the eight family rule and used as a surrogate species for the Topeka Shiner.

Class B(WW-1) Acute Criterion:
As presented in Table 2a, only Brook Trout is deleted from the dataset. A total of 27 genus species are used for the recalculation. The recalculation results in an identical acute criterion as the 304(a) value.

Class B(WW-1) Chronic Criterion:
The chronic criterion is calculated dividing the Final Acute Value by the FACR of 2.917 as provided in the 304(a) criteria document for Chromium. This results in the same chronic criterion as the 304(a) value.

Class B(WW-2) & B(WW-3) Acute Criterion:
For Class B(WW-2) and B(WW-3) designations, *Simocephalus spp*. and *Ceriodaphnia spp*. are deleted from the dataset since they were not found in non-large rivers based on the literature and data search and the family is already represented by the *Daphnia spp*. Also, Brook Trout is deleted since it is a coldwater species. A total of 25 genus species are retained in the dataset. The recalculation results in a different acute criterion than the 304(a) value.

Class B(WW-2) & B(WW-3) Chronic Criterion:
The chronic criteria are calculated by dividing the recalculated Final Acute Value by the FACR of 2.917. This results in a different chronic criterion than the 304(a) value.

Tables 2a and 2b show the species used in the recalculation and the recommended acute and chronic criteria for Chromium.

Table 2a. Recalculation of **Chromium (VI)** Criteria by Species Deletion

Species					**Species Used in Different Stream Designations**		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Daphnia	magna	DAPHNIDAE	cladoceran	23	Yes	Yes*	Yes*
Daphnia	pulex	DAPHNIDAE	cladoceran	36	Yes	Yes*	Yes*

Simocephalus	serrulatus	DAPHNIDAE	cladoceran	41	Yes		
Simocephalus	vetulus	DAPHNIDAE	cladoceran	32	Yes		
Ceriodaphnia	reticulata	DAPHNIDAE	cladoceran	45	Yes		
Gammarus	pseudolimnaeus	GAMMARIDAE	amphipod	67	Yes	Yes	Yes
crangonyx	pseudogracilis	GAMMARIDAE	amphipod	583	Yes	Yes	Yes
Hyalella	azteca	HYALELLIDAE	amphipod	630	Yes	Yes	Yes
Plumatella	emarginata	PLUMATELLIDAE	bryozoan	650	Yes	Yes	Yes
Pectinatella	magnifica	PECTINATELCIDAE	bryozoan	1440	Yes	Yes	Yes
Lophopodella	carteri	LOPHOPODIDAE	bryozoan	1560	Yes	Yes	Yes
Physa	heterostropha	PHYSIDAE	snail	23010	Yes	Yes	Yes
Poecilia	reticulata	POECILIIDAE	guppy	30000	Yes	Yes	Yes
Morone	saxatilis	PERCICHTHYIDAE	striped bass	30450	Yes	Yes	Yes
Perca	flavescens	PERCIDAE	yellow perch	36300	Yes	Yes	Yes
Etheostoma	nigrum	PERCIDAE	Johnny darter	46000	Yes	Yes	Yes
Pimephales	notatus	CYPRINIDAE	bluntnose minnow	54225	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fathead minnow	41050	Yes	Yes	Yes
Ericymba	buccata	CYPRINIDAE	silverjaw minnow	49600	Yes	Yes	Yes
Campostoma	anomalum	CYPRINIDAE	stoneroller	51250	Yes	Yes	Yes
Tanytarsus	dissimilis	CHIRONOMIDAE	midge	57300	Yes	Yes	Yes
Salvelinus	fontinalis	SALMONIDAE	brook trout	59000			
Chironomus	tentans	CHIRONOMIDAE	midge	61000	Yes	Yes	Yes
Notropis	atherinoides	CYPRINIDAE	emerald shiner	48400	Yes	Yes	Yes
Notropis	chrysocephalus	CYPRINIDAE	striped shiner	85600	Yes	Yes	Yes
Notropis	stramineus	CYPRINIDAE	sand shiner	74600	Yes	Yes	Yes
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	69000	Yes	Yes	Yes
Pomoxis	annularis	CENTRARCHIDAE	white crappie	72600	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	119500	Yes	Yes	Yes
Lepomis	cyanellus	CENTRARCHIDAE	green sunfish	114700	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	bluegill	132900	Yes	Yes	Yes
Enallagma	aspersum	COENAGRIONIDAE	damselfly	140000	Yes	Yes	Yes
Orconectes	rusticus	ASTACIDAE	crayfish	176000	Yes	Yes	Yes
Neophasganophora	capitata	PERLIDAE	stonefly	1870000	Yes	Yes	Yes
			Number of Species, N		27	25	25
			FINAL ACUTE VALUE (ug/l)		31.49	39.13	39.13
			ACUTE/CHRONIC RATIO		2.917	2.917	2.917
			Recalculated CMC ((ug/l)		15.75	19.567	19.567
			FINAL CMC		16	20	20
			Recalculated CCC (ug/l)		10.795	13.41	13.41
			FINAL CCC((ug/l)		11	13	13

Protection for Endangered Species: The 304(a) criteria are proposed for the Class B(WW-1) designation. Thus, the ESA consultation is deferred to the national level. For Class B(WW-2) and Class B(WW-3), both the Sand Shiner and the Rainbow Trout are used as surrogate species to the Topeka Shiner. The Final Acute Value (39.13 ug/l) and the CMC is much lower than the species mean acute values for both Sand Shiner (74,600 ug/l) and Rainbow Trout (69,000 ug/l). Also, the 304(a) criteria for chromium are expressed in terms of the dissolved metal in the water column. IDNR implements the criteria as total recoverable metal. Thus, the recalculated criteria for Class B(WW-2) and Class B(WW-3) are determined to be protective of Topeka Shiner.

Table 2b. Current and Proposed IDNR Aquatic Life Criteria for **Chromium (VI)** (total, unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	60	16	300	20	300	20	16
Chronic(CCC)	40	11	200	13	200	13	11

3. Copper

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: The recalculation is based on the 1995 Updates for Copper. A total of 43 genus species are included in the national toxicity dataset. The following species deletion process applies to all three designations. Rainbow Trout is used as the surrogate species for Topeka Shiner to protect this endangered species. All coldwater species except Rainbow Trout (Coho Salmon, Sockeye Salmon, Chinook Salmon, Cutthroat Trout, Atlantic Salmon, and Brook Trout) are deleted from the dataset. Guppy is deleted since the Mosquitofish is already in the dataset. *Tilapia spp.* is not a resident species in Iowa, therefore it is deleted since the Order *Perciformes* is represented by Striped Bass and White Perch.

Class B(WW-1) Acute Criterion:
A total of 39 genus species are retained in the dataset for the recalculation. The recalculation results in more stringent acute criterion than the 304(a) values. The 304(a) criterion is proposed as the acute criterion for Class B(WW-1).

Class B(WW-1) Chronic Criterion:
The chronic criterion is calculated by dividing the Final Acute Value by the FACR of 2.823 as provided in the 304(a) criteria documents for Copper. The recalculation results in more stringent chronic criterion than the 304(a) values. The 304(a) criterion is proposed as the chronic criterion for Class B(WW-1).

Class B(WW-2) & B(WW-3) Acute Criterion:
The same species deleted from Class B(WW-1) dataset are deleted for Class B(WW-2) and B(WW-3) dataset. In addition, *Ceriodaphnia spp.* is deleted from the dataset for B(WW-2) and B(WW-3) since it is not a resident species in small wadable streams based on the research data (see Appendix A). A total of 38 genus species are used in the recalculation dataset. The recalculation results in a different acute criterion than the 304(a) criterion for Class B(WW-2) and B(WW-3) designations.

Class B(WW-2)&B(WW-3) Chronic Criterion:
The chronic criterion is calculated by dividing the recalculated Final Acute Value by the FACR of 2.823 as provided in the 304(a) criteria documents for Copper. The recalculation results in a different chronic criterion than the 304(a) criterion for Class B(WW-2) and B(WW-3) designations.

The toxicity for Copper is hardness dependent. Tables 3a and 3b show the species used in the recalculation and the proposed Copper criteria as a function of hardness as CaCO3.

Table 3a. Recalculation of **Copper** Criteria by Species Deletion

SPECIES					Species Used in Different Stream Designations		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Ceriodaphnia	reticulata	DAPHNIDAE	cladoceran	9.92	Yes		
Daphnia	magna	DAPHNIDAE	cladoceran	19.88	Yes	Yes	Yes
Daphnia	pulex	DAPHNIDAE	cladoceran	16.5	Yes	Yes	Yes
Daphnia	pulicaria	DAPHNIDAE	cladoceran	9.263	Yes	Yes	Yes
Ptychocheilus	oregonenesis	CYPRINIDAE	squawfish	16.74	Yes	Yes	Yes
Gammarus	pseudolimnaeus	GAMMARIDAE	amphipod	22.09	yes	yes	yes
Plumatella	emarginata	PLUMATELLIDAE	bryozoan	37.05	Yes	Yes	Yes
Lophopodella	carteri	LOPHOPODIDAE	bryozoan	37.05	Yes	Yes	Yes
Physa	heterostropha	PHYSIDAE	snail	35.91	yes	yes	yes
Physa	integra	PHYSIDAE	snail	43.07	yes	yes	yes
Morone	americanus	PERCICHTHYIDAE	white perch	5860	yes	yes	yes
Morone	saxatilis	PERCICHTHYIDAE	Striped bass	52	yes	yes	yes
Limnodrilus	hoffmeisteri	TUBIFICIDAE	worm	53.08	yes	yes	yes
Gyraulus	circumstriatus	PLANORBIDAE	snail	56.21	yes	yes	yes
Ictalurus	nebulosus	ICTALURIDAE	brown bullhead	69.81	Yes	Yes	Yes
Oncorhynchus	kisutch	SALMONIDAE	coho salmon	87.1			
Oncorhynchus	nerka	SALMONIDAE	sockeye salmon	233.8			
Oncorhynchus	tshawytscha	SALMONIDAE	chinook salmon	42.26			
Oncorhynchus	clarkii	SALMONIDAE	cutthroat trout	66.26			
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	38.89	Yes	Yes	Yes
Campostoma	anomalum	CYPRINIDAE	stoneroller	78.55	Yes	Yes	Yes
Poecilia	reticulata	POECILIIDAE	guppy	83			
Semotilus	atromaculatus	CYPRINIDAE	creek chub	83.97	Yes	Yes	Yes
Rhinichthys	atratulus	CYPRINIDAE	blacknose dace	86.67	Yes	Yes	Yes
Nais	sp.	NAIDIDAE	worm	90	Yes	Yes	Yes
Pimephales	notatus	CYPRINIDAE	bluntnose minnow	72.16	yes	yes	yes
Pimephales	promelas	CYPRINIDAE	fathead minnow	132.9	Yes	Yes	Yes
Salmo	salar	SALMONIDAE	atlantic salmon	109.9			
Salvelinus	fontinalis	SALMONIDAE	brook trout	110.4			
Acrocheilus	alutaceus	CYPRINIDAE	chiselmouth	133	Yes	Yes	Yes
Pectinatella	magnifica	PECTINATELCIDAE	bryozoan	135	Yes	Yes	Yes
Etheostoma	caeruleum	PERCIDAE	rainbow darter	86.67	Yes	Yes	Yes
Etheostoma	spectabile	PERCIDAE	orangethroat darter	230.2	Yes	yes	yes
Cyprinus	carpio	CYPRINIDAE	carp	156.8	yes	yes	yes
Goniobasis	livescens	PLEUROCERIDAE	snail	166.2	yes	yes	yes
Chironomus	tentans	CHIRONOMIDAE	midge	197	Yes	yes	yes
Chironomus	sp.	CHIRONOMIDAE	midge	30	yes	yes	yes
chironomus	decorus	CHIRONOMIDAE	midge	834	yes	yes	yes
Gambusia	affinis	POECILIIDAE	mosquitofish	196.1	Yes	Yes	Yes
Lumbriculus	variegatus	LUMBRICULIDAE	worm	242.7	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	289	Yes	Yes	Yes
Notropis	chrysocephalus	CYPRINIDAE	striped shiner	331.8	Yes	Yes	Yes
Tilapia	mossambica	CICHLIDAE	tilapia	684.3			

Fundulus	diaphanus	CYPRINODONTIDAE	killifish	790.6	Yes	yes	Yes
Amnicola	sp.	BITHYNIIDAE	snail	900	Yes	Yes	Yes
Lepomis	gibbosus	CENTRARCHIDAE	pumpkinseed	640.9	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	bluegill	1742	Yes	Yes	Yes
crangonyx	pseudogracilis	CRANGONIDAE	amphipod	1290	Yes	Yes	Yes
Orconectes	rusticus	ASTACIDAE	crayfish	1397	Yes	Yes	Yes
Campeloma	decisum	VIVIPARIDAE	snail	1877	Yes	Yes	Yes
Procambarus	clarkii	ASTACIDAE	crayfish	1990	Yes	Yes	Yes
Anguilla	rostrata	ANGUILLIDAE	american eel	4305	Yes	Yes	Yes
Odonata	sp.	COENAGRIONIDAE	damselfly	4600	Yes	Yes	Yes
Trichoptera	sp.	HELICOPSYCHIDAE	caddisfly	6200	Yes	Yes	Yes
Corbicula	manilensis	CORBICULIDAE	Asiatic clam	>7184	Yes	Yes	Yes
Acroneuria	lycorias	PERLIDAE	stonefly	10240	Yes	Yes	Yes
			Number of Species, N		39	38	38
			FINAL ACUTE VALUE (g/l)		13.81	18.44	18.44
			ACUTE/CHRONIC RATIO		2.823	2.823	2.823
			Recalculated CMC ((ug/l)		6.905	9.22	9.22
			FINAL CMC(total)		EXP(0.9422Lnhardness-1.700)*	EXP(0.9422Lnhardness-1.464	EXP(0.9422Lnhardness-1.464
			Recalculated CCC (ug/l)		EXP(0.8545Lnhardness-1.755)	EXP(0.8545Lnhardness-1.466	EXP(0.8545Lnhardness-1.466
			FINAL CCC((ug/l)(total)		EXP(0.8545Lnhardness-1.702)*	EXP(0.8545Lnhardness-1.466	EXP(0.8545Lnhardness-1.466
			* Adopt national criteria				

Protection for Endangered Species: The 304(a) criteria are proposed for the Class B(WW-1) designation. Thus, the ESA consultation is deferred to the national level. Also, research data show that the LC50 for the Shovelnose Sturgeon is twice the value for Rainbow Trout, and the LC50 value for Shortnose Sturgeon is the same as that for Rainbow Trout (Dwyer, F.J., et al., 2005). The Non-Observed Effect Concentration for the Shortnose Sturgeon is about 50 ug/l at hardness of 160 to 180 mg/l as CaCO3 (Dwyer, F.J., et al., 2005). The recommended acute criterion is 22 ug/l to 24 ug/l at a hardness of 160 mg/l and 180 mg/ as CaCO3. Thus, the acute criteria are protective of Pallid Sturgeon if Shortnose Sturgeon is used as the surrogate species. Also, the recalculated chronic criterion for Class B(WW-1), B(WW-2) and B(WW-3) are 10.9 ug/l, 13.8 ug/l and 13.8 ug/l at a hardness of 120 mg/l as CaCO3, which is lower than that chronic value of 22 ug/l for the protection of Rainbow Trout (Seim et al., 1984). The recalculated chronic criterion for Class B(WW-1), B(WW-2) and B(WW-3) are 4.72 ug/l, 5.97 ug/l and 5.97 ug/l at a hardness of 45 mg/l as CaCO3, which is lower than the chronic value of 19 ug/l for the protection of Rainbow Trout (McKim et al., 1978). If Rainbow Trout is used as the surrogate species for Topeka Shiner, the recalculated criteria is determined to be protective of Topeka Shiner for all three designations.

It is important to point out that even though the recalculated criteria are based on the final 1995 Copper criteria instead of the draft 2003 criteria, the recalculated criteria are protective of endangered species. IDNR staff reviewed the draft 2003 304(a) criteria for Copper. The current 1995 final criteria document calculates the criteria as a function of hardness. The draft criteria

recommends a new method called Biotic Ligand Model (BLM model) to calculate site specific criteria as a function of several other parameters such as pH, temperature, alkalinity, dissolved organic carbon, major ions (Ca, Mg, Na, and K), and sulfide in addition to hardness. Since the draft 2003 Copper criteria value depends on more water quality characteristics, it will most likely result in more relaxed criteria if site-specific water quality parameters are used. Currently, there is no implementation guidance for the BLM approach. The draft 2003 Copper criteria document indicates that EPA is currently in the process of developing the BLM implementation guidance. At this time, IDNR staff believes it is appropriate to delay the application of the draft 2003 304(a) criteria until the BLM implementation guidance becomes available.

Table 3b. Current and Proposed IDNR Aquatic Life Criteria for **Copper** (unit in μg/l)

Criteria*	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	60	EXP(0.9422Lnhardness-1.700)	90	EXP(0.9422Lnhardness-1.464	90	EXP(0.9422Lnhardness-1.464	EXP(0.9422Lnhardness-1.700)
Chronic(CCC)	35	EXP(0.8545Lnhardness-1.702)*	55	EXP(0.8545Lnhardness-1.466	55	EXP(0.8545Lnhardness-1.466	EXP(0.8545Lnhardness-1.702)*

Table 3c. Current and Proposed IDNR Aquatic Life Criteria for **Copper** at Hardness 100 mg/l as CaCO3 (unit in μg/l)

Criteria*	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	60	14	90	17.7	90	17.7	14
Chronic(CCC)	35	9.3	55	11.8	55	11.8	9.3

4. Mercury

EPA issue: When the criteria were recalculated by IDNR in 2000, IDNR did not comply with the eight family rule, further, all Cladocerans were deleted from the database; an exception was made for including Cladocerans when recalculating criteria for the lakes and wetlands use category. For the lakes and wetlands use category, IDNR informed EPA that there was a clerical error made in criteria values identified in the table.

Criteria recalculation: The recalculation is made through species deletion based on the EPA toxicity test database in the 1995 Updates (US EPA, 1996). There are a total of 29 genus species in the national toxicity dataset for acute toxicity. Coho Salmon is deleted from the dataset for all three designations since Coho Salmon is a cold water species. *Tilapia spp.* is not a resident species in Iowa, but it is retained for all three designations to represent the Order *Perciformes* since there is no other species in the same Order in the dataset.

Class B(WW-1) Acute Criterion:
Since only Colo Salmon is deleted from the dataset, the total number of genus species remains the same as the original dataset. This results in the same acute criterion as the 304(a) acute value.

Class B(WW-1) Chronic Criterion:

The chronic criterion is calculated by dividing the Final Acute Value by the FACR of 3.731 as provided in the 1995 304(a) criteria document for Mercury. This results in the same chronic criterion as the 304(a) chronic value.

Class B(WW-2) & B(WW-3) Acute Criterion:
Ceriodaphnia reticulata is deleted from the dataset for Class B(WW-2) and Class B(WW-3) designations since IDNR research indicates that *Ceriodaphnia spp*. is not a resident species in these stream conditions (Appendix A). Rainbow Trout is used as the surrogate species for Topeka Shiner. A total of 28 genus species in the dataset is used in the recalculation. The recalculation results in a different criterion than the 304(a) criterion.

Class B(WW-2) & B(WW-3) Chronic criterion:
The chronic criterion is calculated by dividing the recalculated Final Acute Value by the FACR of 3.731 as provided in the 1995 304(a) criteria document for Mercury. This results in a different chronic criterion than the 304(a) chronic value.

Tables 4a and 4b show the species used in the recalculation and the proposed new acute and chronic criteria for Mercury.

Table 4a. Recalculation of **Mercury** Criteria by Species Deletion

SPECIES					Species Used in Different Stream Designations		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Ceriodaphnia	reticulata	DAPHNIDAE	Cladoceran	2.9	Yes		
Daphnia	magna	DAPHNIDAE	cladoceran	3.7	Yes	Yes*	Yes*
Daphnia	pulex	DAPHNIDAE	cladoceran	2.9	Yes	Yes*	Yes*
Gammarus	sp.	GAMMARIDAE	amphipod	10	Yes	Yes*	Yes*
Faxonella	clypeatus	ASTACIDAE	crayfish	20	Yes	Yes*	Yes*
Poecilia	reticulata	POECILIIDAE	guppy	28	Yes	Yes	Yes
Orconectes	limosus	ASTACIDAE	crayfish	50	Yes	Yes	Yes
Amnicola	sp.	HYDROBIIDAE	snail	80	Yes	Yes	Yes
Branchiura	sowerbyi	TUBIFICIDAE	tubificid worm	80	Yes	Yes	Yes
Varichaeta	pacifica	TUBIFICIDAE	tubificid worm	100	Yes	Yes	Yes
Chironomus	sp.	CHIRONOMIDAE	midge	20	Yes	Yes	Yes
Chironomus	riparius	CHIRONOMIDAE	midge	750	Yes	Yes	Yes
Stylodrilus	heringianus	TUBIFICIDAE	tubificid worm	140	Yes	Yes	Yes
Tubifex	tubifex	TUBIFICIDAE	tubificid worm	140	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	bluegill	160	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fathead minnow	163	Yes	Yes	Yes
Limnodrilus	hoffmeisteri	TUBIFICIDAE	tubificid worm	180	Yes	Yes	Yes
Gambusia	affinis	POECILIIDAE	mosquitofish	203	Yes	Yes	Yes
Rhyacodrilus	montana	TUBIFICIDAE	tubificid worm	240	Yes	Yes	Yes
Quistradrilus	multisetosus	TUBIFICIDAE	tubificid worm	250	Yes	Yes	Yes
Oncorhynchus	kisutch	SALMONIDAE	coho salmon	240			
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	275	Yes	Yes	Yes
Aplexa	hypnorum	PHYSIDAE	snail	370	Yes	Yes	Yes
Clarias	batrachus	CLARIIDAE	walking	375	Yes	Yes	Yes

			catfish				
Spirosperma	ferox	TUBIFICIDAE	tubificid worm	500	Yes	Yes	Yes
Spirosperma	nikoiskyi	TUBIFICIDAE	tubificid worm	330	Yes	Yes	Yes
Tilapia	mossambica	CICHLIDAE	tilapia	1000	Yes	Yes	Yes
Nais	sp.	NAIDIDAE	worm	1000	Yes	Yes	Yes
Odonata	sp.	COENAGRIONIDAE	damselfly	1200	Yes	Yes	Yes
Trichoptera	sp.	HELICOPSYCHIDAE	caddisfly	1200	Yes	Yes	Yes
Hydropsyche	betteni	HYDROPSYCHIDAE	caddisfly	2000	Yes	Yes	Yes
Ephemerella	subvaria	EPHEMERELLIDAE	mayfly	2000	Yes	Yes	Yes
Acroneuria	lycorias	PERLIDAE	stonefly	2000	Yes	Yes	Yes
				Number of Species, N	29	28	28
				FINAL ACUTE VALUE (ug/l)	3.388	5.62	5.62
				ACUTE/CHRONIC RATIO	3.731	3.731	3.731
				Recalculated CMC ((ug/l)	1.694	2.81	2.81
				FINAL CMC(total)	1.7*	2.8	2.8
				Recalculated CCC (ug/l)	0.91	1.51	1.51
				FINAL CCC((ug/l)(total)	0.9*	1.50	1.50

Protection for Endangered Species: The 304(a) criteria are proposed for the Class B(WW-1) designation. Thus, the consultation is deferred to the national level. For Class B(WW-2) and B(WW-3) designations, Rainbow Trout is used as the surrogate species for Topeka Shiner. The Final Acute Value for Class B(WW-2) and B(WW-3) streams is 5.62 ug/l which is much lower than the Species Mean Acute Value of 275 ug/l for Rainbow Trout. Thus, the recalculated criteria for Class B(WW-2) and B(WW-3) designations are determined to be protective of the Topeka Shiner.

Table 4b. Current and Proposed IDNR Aquatic Life Criteria for **Mercury** (total, unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria (as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	4.0	1.7	6.9	2.7	6.9	2.7	1.7
Chronic(CCC)	2.1	0.9	3.7	1.5	3.7	1.5	0.91

5. Zinc

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: Criteria recalculations are conducted using species deletion based on the toxicity data in the 1995 Updates. A total of 36 genus species are available in the national dataset for acute toxicity. All coldwater species except Rainbow Trout (Coho Salmon, Sockeye Salmon, Chinook Salmon, Brook Trout, and Atlantic Salmon) are deleted from the dataset for all three designations. Rainbow Trout is used as the surrogate species for the Topeka Shiner to protect this endangered species. Platy Fish is deleted since Mosquitofish is the only resident species in the Family of *Poeciliidae*, which is represented by Guppy in the dataset. *Tilapia spp.* is not a resident species in Iowa, and therefore it is deleted since the Order *Perciformes* is represented by the Striped Bass.

Class B(WW-1) Acute Criterion:
The species deletion process reduced the total number of genus species from 36 to 32. The recalculation results in a lower value than the 304(a) criterion because of the effect of a reduced number of total species in the dataset. Since the 304(a) criterion is already determined to be adequately protective of aquatic species in the dataset, the 304(a) criterion is proposed as the acute criterion for Class B(WW-1) designation.

Class B(WW-1) Chronic Criterion:
The chronic criteria for Zinc is calculated by dividing the Final Acute Value by the FACR value of 2.0 provided in the Zinc 304(a) criteria document. This results in the same chronic criterion as the 304(a) criterion.

Class B(WW-2) & B(WW-3) Acute Criterion:
Based on the research data (see Appendix A), *Ceriodaphnia spp*. is deleted from the dataset for B(WW-2) and B(WW-3) since it is not a resident species in small wadable streams. The recalculation results in a different criterion than the 304(a) acute value.

Class B(WW-2) & B(WW-3) Chronic Criterion:
The chronic criteria for Zinc is calculated by dividing the recalculated Final Acute Value by the FACR value of 2.0 provided in the Zinc 304(a) criteria document. This results in a different chronic criterion than the 304(a) chronic value.

The toxicity for Zinc is hardness dependent. Tables 5a and 5b show the species used in the calculation and the proposed acute and chronic criteria as a function of hardness as CaCO3.

Table 5a. Recalculation of **Zinc** Criteria by Species Deletion

SPECIES					Species Used in Different Stream Designations		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Ceriodaphnia	dubia	DAPHNIDAE	cladoceran	174	Yes		
Ceriodaphnia	reticulata	DAPHNIDAE	cladoceran	51	Yes		
Morone	saxatilis	PERCICHTHYIDAE	striped bass	119.4	Yes	Yes	Yes
Agosia	chrysogaster	CYPRINIDAE	longfin dace	227.8	Yes	Yes	Yes
Daphnia	magna	DAPHNIDAE	cladoceran	356	Yes	Yes	Yes
Daphnia	pulex	DAPHNIDAE	cladoceran	253	Yes	Yes	Yes
Tilapia	mossambica	CICHLIDAE	Mozambique Tilapia	790.0			
Oncorhynchus	kisutch	SALMONIDAE	coho salmon	1628			
Oncorhynchus	nerka	SALMONIDAE	sockeye salmon	1502			
Oncorhynchus	tshawytscha	SALMONIDAE	chinook salmon	446.4			
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	689.3	Yes	Yes	Yes
Limnodrilus	hoffmeisteri	TUBIFICIDAE	tubificid	>1264	Yes	Yes	Yes
Pectinatella	magnifica	PECTINATELCIDAE	bryozoan	1307	Yes	Yes	Yes
Physa	gyrina	PHYSIDAE	snail	1683	Yes	Yes	Yes
Physa	heterostropha	PHYSIDAE	snail	1088	Yes	Yes	Yes
Helisoma	campanulatum	PLANORBIDAE	snail	1578	Yes	Yes	Yes
Plumatella	rostrata	PLUMATELLIDAE	bryozoan	1607	Yes	Yes	Yes
Jordanella	floridae	CYPRINODONTIDAE	flagfish	1672	Yes	Yes*	Yes*
Lophopodella	carteria	LOPHOPODIDAE	bryozoan	1707	Yes	Yes	Yes

Salvelinus	fontinalis	SALMONIDAE	brook trout	2100			
Salmo	salar	SALMONIDAE	atlantic salmon	2176			
Lirceus	alabamae	ASELLIDAE	isopod	3265	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	Fathead minnow	3830	Yes	Yes	Yes
Xiphophorus	maculatus	POECILIIDAE	platy fish	4341			
Corbicula	fluminea	CORBICULIDAE	asiatic clam	4900	Yes	Yes	Yes
Catostomus	commersoni	CATOSTOMIDAE	white sucker	5228	Yes	Yes	Yes
Notemigonus	crysoleucas	CYPRINIDAE	golden shiner	6000	Yes	Yes	Yes
Poecilia	reticulata	POECILIIDAE	guppy	6053	Yes	Yes	Yes
Ptychocheilus	oregonensis	CYPRINIDAE	squawfish	6580	Yes	Yes	Yes
Cyprinus	carpio	CYPRINIDAE	carp	7233	Yes	Yes	Yes
Gammarus	sp.	GAMMARIDAE	amphipod	8100	Yes	Yes	Yes
Asellus	bicrenata	ASELLIDAE	isopod	5731	Yes	Yes	Yes
Asellus	communis	ASELLIDAE	isopod	11610	Yes	Yes	Yes
Lumbriculus	variegatus	LUMBRICULIDAE	worm	9712	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	10250	Yes	Yes	Yes
Lepomis	gibbosum	CENTRARCHIDAE	pumpkinseed	18790	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	bluegill	5938	Yes	Yes	Yes
Anguilla	rostrata	ANGUILLIDAE	american eel	13630	Yes	Yes	Yes
Amnicola	sp.	BITHYNIIDAE	snail	16820	Yes	Yes	Yes
Fundulus	diaphanus	CYPRINODONTIDAE	killifish	17940	Yes	Yes	Yes
Nais	sp.	NAIDIDAE	worm	18400	Yes	Yes	Yes
Xenopus	lavis	PIPIDAE	frog	19176	Yes	Yes	Yes
Crangonyx	pseudogracilis	CRANGONIDAE	amphipod	19800	Yes	Yes	Yes
Argia	sp.	COENAGRIONIDAE	damselfly	88960	Yes	Yes	Yes
			Number of Species, N		32	31	31
			FINAL ACUTE VALUE (g/l)		121	173.12	173.12
			ACUTE/CHRONIC RATIO		2.00	2.00	2.00
			Recalculated CMC ((ug/l)		Exp(0.8473ln Hardness+0.789	Exp(0.8473lnHardness+1.146	Exp(0.8473lnHardness+1.146
			FINAL CMC(total)		*Exp(0.8473lnHardness+0.884	Exp(0.8473lnHardness+1.146	Exp(0.8473lnHardness+1.146
			Recalculated CCC (ug/l)		Exp(0.8473ln Hardness+0.789	Exp(0.8473lnHardness+1.146	Exp(0.8473lnHardness+1.146
			FINAL CCC((ug/l)(total)		*Exp(0.8473lnHardness+0.884	Exp(0.8473lnHardness+1.146	Exp(0.8473lnHardness+1.146
			* CMC for B(ww-1) adopts 304(a) criteria				

Protection for Endangered Species: The 304(a) criteria are proposed for the Class B(WW-1) designation. Thus, consultation is deferred to the national level. For Class B(WW-2) and B(WW-3) designations, Rainbow Trout is used as the surrogate species for Topeka Shiner. The Final Acute Value for Class B(WW-2) and B(WW-3) streams is 173 ug/l which is much lower than the Species Mean Acute Value of 689.3 ug/l for Rainbow Trout. Also, Golden Shiner, which is in the same family as Topeka Shiner, is in the toxicity dataset. The calculated Final Acute Value of 173 ug/l for Class B(WW-2) and B(WW-3) designations are much lower than the Species Mean Acute value of 6,000 ug/l for Golden Shiner. Thus, the recalculated criteria for Class B(WW-2) and B(WW-3) designations are determined to be protective of Topeka Shiner.

Table 5b. Current and Proposed IDNR Aquatic Life Criteria for **Zinc** (total, unit in μg/l)

Criteria*	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	500	Exp(0.8473 lnHardness +0.884	2200	Exp(0.8473l nHardness+1 .146	2200	Exp(0.8473ln Hardness+1.1 46	Exp(0.8473lnHard ness+0.884
Chronic(CCC)	450	Exp(0.8473 lnHardness +0.884	2000	Exp(0.8473l nHardness+1 .146	2000	Exp(0.8473ln Hardness+1.1 46	Exp(0.8473lnHard ness+0.884

At hardness of 100 mg/l as CaCO3. CF=0.9785 (CMC), 0.986 (CCC).

Table 5c. Current and Proposed IDNR Aquatic Life Criteria for **Zinc**
At hardness 100 mg/l as CaCO3 (total, unit in μg/l)

Criteria*	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	500	120	2200	156	2200	156	120
Chronic(CCC)	450	120	2000	156	2000	156	120

CF=0.9785 (CMC), 0.986 (CCC).

6. Aluminum

EPA issue: When the criteria were recalculated by IDNR in 2000, IDNR did not comply with the eight family rule, further, all Cladocerans were deleted from the database; an exception was made for including Cladocerans when recalculating criteria for the lakes and wetlands use category.

Criteria recalculation: The criteria are recalculated to meet the 8 family rule and *Daphnia spp.* are kept in the recalculation for all warm water designations. For the recalculation, cold water species such as Brook Trout and Chinook Salmon are deleted from the dataset for all three designations since they are not a resident species in warm water streams.

Class B(WW-1) Acute Criterion:
Only Brook Trout and Chinook Salmon are deleted from the toxicity dataset. The recalculation results in a different criterion than the 304(a) criterion.

Class B(WW-1) Chronic Criterion:
The chronic criterion is calculated by dividing the recalculated Final Acute Value by the FACR. The recalculation results in an almost identical value as the 304(a) criterion. The chronic 304(a) criterion is proposed as the chronic criterion for Class B(WW-1).

Class B(WW-2) & B(WW-3) Acute Criterion:
According to IDNR research (Appendix A), *Ceriodaphnia spp*. are not resident species in non-large rivers such as Class B(WW-2) and B(WW-3) designations. Thus, they are deleted from the dataset for Class B(WW-2) and B(WW-3) designations. The recalculation results in a different criterion than the 304(a) criterion.

Class B(WW-2) & B(WW-3) Chronic Criterion:
The chronic criterion is calculated by dividing the recalculated Final Acute Value by the FACR. The recalculation results in a different value than the 304(a) criterion for Class B(WW-2) and B(WW-3).

Tables 6a and 6b show what species are used in the recalculation and the proposed new criteria for Aluminum.

Table 6a. Recalculation of **Aluminum** Criteria by Species Deletion

SPECIES					Species Used in Different Stream Designations		
GENUS	SPECIES	COMMON	FAMILY	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Ceriodaphnia	dubia	cladoceran	DAPHNIDAE	1900	Yes		
Ceriodaphnia	sp.	cladoceran	DAPHNIDAE	3690	Yes		
Salvelinus	fontinalis	brook trout	SALMONIDAE	3600			
Oncorhynchus	mykiss	rainbow trout	SALMONIDAE	10390	Yes	Yes	Yes
Gammarus	pseudolimnaeus	amphipod	GAMMARIDAE	22000	Yes	Yes	Yes
Acroneuria	sp.	stonefly	PERLIDAE	>22600	Yes	Yes	Yes
Dugesia	tigrina	planarian	PLANARIIDAE	>23000	Yes	Yes	Yes
Physa	sp.	snail	PHYSIDAE	30600	Yes	Yes	Yes
Pimephales	promelas	fathead minnow	CYPRINIDAE	35000	Yes	Yes	Yes
Daphnia	magna	cladoceran	DAPHNIDAE	38200	Yes	Yes*	Yes*
Oncorhynchus	tshawytscha	chinook salmon	SALMONIDAE	>40000			
Ictalurus	punctatus	channel catfish	ICTALURIDAE	>47900	Yes	Yes	Yes
Perca	flavescens	yellow perch	PERCIDAE	>49800	Yes	Yes*	Yes*
Lepomis	cyanellus	green sunfish	CENTRARCHIDAE	>50000	Yes	Yes	Yes
Tanytarsus	dissimilis	midge	CHIRONOMIDAE	>79900	Yes	Yes	Yes
				Number of Species, N	12	11	11
				FINAL ACUTE VALUE (ug/l)	1966	9351	9351
				ACUTE/CHRONIC RATIO	23.4	23.4	23.4
				Recalculated CMC ((ug/l)	983	4675	4675
				FINAL CMC	983	4675	4675
				Recalculated CCC (ug/l)	84	400	400
				FINAL CCC((ug/l)	87*	400	400
			* Adopts 304(a) criteria				

Protection for Endangered Species: First of all, Aluminum is a non-priority pollutant. The recalculated acute criterion of 980 ug/l for Class B(WW-1) is much less than the most sensitive fish species tested, Brook Trout, 3600 ug/l. Also, it is found that the maximum toxicity for Aluminum occurred in the pH range of 5.8 to 6.2 (U.S. EPA, 1988). The acute toxicity for Brook Trout was conducted at a pH 6.5. Normally, the pH value in the ambient waters is close to 8. The water quality summary based on the ambient monitoring data from 2000 to 2005 shows that the 10^{th} percentile for pH is 7.8 and the state water quality standard for pH is 6.5 to 9. Thus, the recalculated criterion should be protective all fish species including the endangered species, Pallid Sturgeon. The toxicity data for snail (in the same Phylum as mussels) shows much more resistance (Species Mean Acute Value of 30,600 ug/l) to aluminum toxicity than the Brook Trout (Species Mean Acute Value of 3600 ug/l). Thus, the recalculated criterion also is determined to be protective of mussel species, including the endangered Scaleshell Mussels.

Topeka Shiner is the endangered species that may reside in Class B(WW-2) and Class B(WW-3) designated streams. Rainbow Trout is used as the surrogate species for Topeka Shiner. The recalculated acute criterion of 4675 ug/l for Class B(WW-2) and B(WW-3) designations are much lower than the species mean acute value for Rainbow Trout. For chronic protection, the Final Chronic Value recommended by EPA (U.S. EPA, 1988) is 748 ug/l, which is lowered to 87

ug/l to protect the Striped Bass. As indicated in the 2006 published national criteria (U.S. EPA, 2006), "the value of 87 ug/l is based on a toxicity test with the Striped Bass in water with pH=6.5-6.6 and hardness <10 mg/l. Data in 'Aluminum Water-Effect Ratio for the 3M Plant Effluent Discharge, Middleway, West Virginia' indicate that Aluminum is substantially less toxic at higher pH and hardness." Also, Freeman and Everhart (1971) showed the EC50 for Rainbow Trout fingerling at pH of 8.0 is 5,230 ug/l in a 32-day test. The study by Everhart and Freeman (1973) indicated no reduced fertility on Rainbow Trout embryos at an Aluminum concentration of 5,200 ug/l with a pH range of 7 – 9. Thus, the recalculated acute and chronic criteria are protective of endangered species.

Table 6b. Current and Proposed IDNR and EPA Aquatic Life Criteria for **Alumimum** (unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria (as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	4,539	980	9,035	4680	9,035	4680	750
Chronic(CCC)	388	87	773	400	773	400	87

B. Chemicals for which the 304(a) Criteria are Proposed

7. Arsenic (III)

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: The criteria for Class B(WW-1), B(WW-2) and B(WW-3) are recalculated based on species deletion and EPA toxicity database in the 1995 Updates (US EPA, 1996). A total of fourteen genus are included in the EPA toxicity dataset. For the recalculation, Rainbow Trout is used as a surrogate species for Topeka Shiner to protect this endangered species since the Rainbow Trout is usually more sensitive than other warm water endangered species. Also, Rainbow Trout is kept to meet the eight family rule for the criteria recalculation. For the recalculation, the cold water species Brook Trout is deleted for all three designations.

Class B(WW-1) Acute Criterion:
Total number of genus used is thirteen since Brook Trout is deleted. The recalculation results in a lower criterion. The 304(a) acute criterion of 340 ug/l as total arsenic is proposed.

Class B(WW-1) Chronic Criterion:
The chronic criterion is calculated using the recalculated Final Acute Value (FAV) divided by the Final Acute Chronic Ratio (FACR) of 4.594. The recalculation results in lower criteria. The 304(a) chronic criterion of 150 ug/l as total arsenic is proposed.

Class B(WW-2) & B(WW-3) Acute Criterion:
For Class B(WW-2) and B(WW-3) designations, *Simocephalus spp*. and *Ceriodaphnia spp*. are deleted from the dataset since they were not found in non-large rivers based on the literature and data search (Appendix A). Total number of genus used in the recalculation is eleven. The species deletion process resulted in lower values for the Final Acute Values. The 304(a) criteria are proposed for the Class B(WW-2) and B(WW-3) warm water designations.

Class B(WW-2) & B(WW-3) Chronic Criterion: The chronic criteria are calculated using FAV divided by the Final Acute Chronic Ratio (FACR) of 4.594. The recalculation results in lower criteria. 304(a) chronic criterion of 150 ug/l as total arsenic is proposed.

Tables 7a and 7b show the species deletion procedure and recalculated criteria for Arsenic.

Table 7a. Recalculation of **Arsenic** Criteria by Species Deletion

Species					Species Used in Different Stream Designations		
GENUS	SPECIES	COMMON	FAMILY	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Gammarus	pseudolimnaeus	amphipod	GAMMARIDAE	874	Yes	Yes	Yes
Simocephalus	serrulatus	cladoceran	DAPHNIDAE	812	Yes		
Simocephalus	vetulus	cladoceran	DAPHNIDAE	1700	Yes		
Ceriodaphnia	reticulata	cladoceran	DAPHNIDAE	1511	Yes		
Daphnia	magna	cladoceran	DAPHNIDAE	4449	Yes	Yes	Yes
Daphnia	pulex	cladoceran	DAPHNIDAE	1626	Yes	Yes	Yes
Oncorhynchus	mykiss	rainbow trout	SALMONIDAE	13340	Yes	Yes	Yes
Pimephales	promelas	fathead	CYPRINIDAE	14065	Yes	Yes	Yes
Salvelinus	fontinalis	brook trout	SALMONIDAE	14960			
Ictalurus	punctatus	channel catfish	ICTALURIDAE	18100	Yes	Yes	Yes
Jordanella	floridae	flagfish	CYPRINODONTIDAE	20130	Yes	Yes	Yes
Pteronarcys	californica	stonefly	PTERONARCIDAE	22040	Yes	Yes	Yes
Aplexa	hypnorum	snail	PHYSIDAE	24500	Yes	Yes	Yes
Carassius	auratus	goldfish	CYPRINIDAE	26040	Yes	Yes	Yes
Lepomis	macrochirus	bluegill	CENTRARCHIDAE	41760	Yes	Yes	Yes
Tanytarsus	dissimilis	midge	CHIRONOMIDAE	97000	Yes	Yes	Yes
				Number of Species, N	13	11	11
				FINAL ACUTE VALUE (ug/l)	657.86	423.639	423.639
				ACUTE/CHRONIC RATIO	4.594	4.594	4.594
				Recalculated CMC ((ug/l)	328.93	211.8195	211.8195
				FINAL CMC	340[a]	340[a]	340[a]
				Recalculated CCC (ug/l)	143.20	92.22	92.22
				FINAL CCC((ug/l)	150[a]	150[a]	150[a]
			[a] adopt 304(a) criteria				

Protection for Endangered Species: Since the 304(a) criteria were proposed for each designation use, consultation will be deferred to the national level.

Table 7b. Current and Proposed IDNR Aquatic Life Criteria for **Arsenic** (total, unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria (as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	360	340	1800	340	1800	340	340
Chronic(CCC)	200	150	1000	150	1000	150	150

8. Lead

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: The EPA 304(a) criteria of 1984 contain only 10 species for acute toxicity tests. There is not enough data to develop site specific criteria based on the species deletion procedure. Thus, the 304(a) criteria for Lead are proposed. Table 8 shows the proposed criteria and the current Lead criteria in Iowa.

Table 8. Current and Proposed IDNR Aquatic Life Criteria for **Lead** (total, unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	200	exp(1.2731Ln(hardness)-1.46)	750	exp(1.2731Ln(hardness)-1.46)	750	exp(1.2731Ln(hardness)-1.46)	exp(1.2731Ln(hardness)-1.46)
Chronic(CCC)	30	exp(1.2731Ln(hardness)-4.705)	80	exp(1.2731Ln(hardness)-4.705)	80	exp(1.2731Ln(hardness)-4.705)	exp(1.2731Ln(hardness)-4.705)

Conversion factor, CF=0.79 at hardness 100 mg/l as CaCO3

Table 8a. Current and Proposed IDNR Aquatic Life Criteria for **Lead** At hardness 100 mg/l as CaCO3 (total, unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria(as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	200	82	750	82	750	82	82
Chronic(CCC)	30	3.2	80	3.2	80	3.2	3.2

Conversion factor, CF=0.79 at hardness 100 mg/l as CaCO3

Protection for Endangered Species: Since the 304(a) criteria were proposed for each designation use, consultation will be deferred to the national level.

9. Nickel

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: Based on the EPA recalculation procedure, none of the species in the toxicity dataset could be deleted. The 304(a) criteria are proposed for all three Class B(WW-1), B(WW-2) and B(WW-3) designations. Tables 9a and 9b show the species used in the recalculation and the proposed criteria as a function of the hardness as CaCO3.

Table 9a. Recalculation of **Nickel** Criteria by Species Deletion

SPECIES					**Species Used in Different Stream Designations**		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
physa	gyrina	PHYSIDAE	Snail	416	Yes	Yes	Yes
Daphnia	pulicaria	DAPHNIDAE	cladoceran	2042	Yes	Yes	Yes
Daphnia	magna	DAPHNIDAE	cladoceran	1102	Yes	Yes	Yes
Ambloplites	rupestris	CENTRARCHIDAE	rock bass	4312	Yes	Yes	Yes
Ephemerella	subvaria	EPHEMERELLIDAE	mayfly	4636	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fathead	6707	Yes	Yes	Yes
Morone	americana	PERCICHTHYIDAE	white perch	12790	Yes	Yes	Yes
Morone	saxatilis	PERCICHTHYIDAE	striped bass	5914	Yes	Yes	Yes

Poecilia	reticulata	POECILIIDAE	guppy	9661	Yes	Yes	Yes
Cyprinus	carpio	CYPRINIDAE	common carp	9839	Yes	Yes	Yes
Anguilla	rostrata	ANGUILLIDAE	american eel	12180	Yes	Yes	Yes
Lepomis	gibbosus	CENTRARCHIDAE	pumpkinseed	7544	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	bluegill	21570	Yes	Yes	Yes
Amnicola	sp.	BITHYNIIDAE	snail	12770	Yes	Yes	Yes
Gammarus	sp.	GAMMARIDAE	amphipod	13000	Yes	Yes	Yes
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	13380	Yes	Yes	yes
Nais	sp.	NAIDIDAE	worm	14100	Yes	Yes	Yes
Odonata	sp.	COENAGRIONIDAE	damselfly	21200	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	21320	Yes	Yes	Yes
Trichoptera	sp.	HELICOPSYCHIDAE	caddisfly	3200	Yes	Yes	Yes
Acroneuria	lycorias	PTERONARCIDAE	Stonefly	40460	Yes	Yes	Yes
Fundulus	diaphanis	CYPRINODONTIDAE	banded killifish	43250	Yes	Yes	Yes
Crangonyx	pseudogracilis	CRANGONIDAE	Amphipod	66100	Yes	Yes	Yes
chironomus	riparis	CHIRONOMIDAE	Midge	73208	Yes	Yes	Yes
			Number of Species, N		21	21	21
			FINAL ACUTE VALUE (ug/l)		522.364	522.364	522.364
			ACUTE/CHRONIC RATIO		17.99	17.99	17.99
			Recalculated CMC ((ug/l)		Exp(0.846(lnHardness+2.255)	Exp(0.846(lnHardness+2.255)	Exp(0.846(lnHardness+2.255)
			FINAL CMC(total)		Exp(0.846(lnHardness+2.255)	Exp(0.846(lnHardness+2.255)	Exp(0.846(lnHardness+2.255)
			Recalculated CCC (ug/l)		Exp(0.846(lnHardness+0.0584)	Exp(0.846(lnHardness+0.0584)	Exp(0.846(lnHardness+0.0584)
			FINAL CCC((ug/l)(total)		Exp(0.846(lnHardness+0.0584)	Exp(0.846(lnHardness+0.0584)	Exp(0.846(lnHardness+0.0584)

Protection for Endangered Species: Since the 304(a) criteria were proposed for each designation use, consultation is deferred to the national level.

Table 9b. Current and Proposed IDNR Aquatic Life Criteria for **Nickel** (total, unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	5,800	Exp(0.846(lnHardness+2.255)	7,000	Exp(0.846(lnHardness+2.255)	7,000	Exp(0.846(lnHardness+2.255)	Exp(0.846(lnHardness+2.255)
Chronic(CCC)	650	Exp(0.846(lnHardness+0.0584)	750	Exp(0.846(lnHardness+0.0584)	750	Exp(0.846(lnHardness+0.0584)	Exp(0.846(lnHardness+0.0584)

CF=0.998 (CMC), 0.997 (CCC).

Table 9c. Current and Proposed IDNR Aquatic Life Criteria for **Nickel**
At hardness 100 mg/l as CaCO3 (total, unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	5,800	470	7,000	470	7,000	470	470
Chronic(CCC)	650	52	750	52	750	52	52

CF=0.998 (CMC), 0.997 (CCC).

10. Selenium VI

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: There are not enough acute species toxicity data available to conduct a species deletion recalculation based on the 1995 Updates acute toxicity data. The 304(a) criteria are proposed.

So far, IDNR has adopted Selenium VI as the chemical not the total Selenium. It is fairly costly to measure the two different specimen of Selenium IV and Selenium VI in laboratories, therefore total Selenium is usually measured. Thus, a total Selenium criteria is proposed.

Table 10 shows the proposed acute and chronic criteria for Selenium.

Protection for Endangered Species: Since the 304(a) criteria were proposed for each designation use, consultation is deferred to the national level.

Table 10. Current and Proposed IDNR Aquatic Life Criteria for **Selenium** (total, unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria (as total)
	Current	Proposed	Current	Proposed	Current	Proposed	1995
Acute(CMC)	175	19.3	175	19.3	175	19.3	19.34
Chronic(CCC)	125	5.0	125	5.0	125	5.0	5.0

11. Silver

EPA issue: Iowa never adopted the acute criteria, i.e., it is missing.

Criteria recalculation: Currently, Iowa does have an acute criterion of 100 ug/l for Silver for the Class B(WW-1) and B(WW-2) designations, which are higher than the national criterion. Since the toxicity data in the 1999 Updates are not adequate to conduct a species deletion calculation, the 304(a) criteria are proposed for Class B(WW-1), B(WW-2) and B(WW-3) designations. Table 11 shows the proposed criteria for Silver.

Protection for Endangered Species: Since the 304(a) criteria were proposed for each designation use, consultation is deferred to the national level.

Table 11. Current and Proposed IDNR Aquatic Life Criteria for **Silver** (total, unit in µg/l)

Criteria*	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria (as total)
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	100	4.0	100	4.0	100	4.0	4.0
Chronic(CCC)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

At hardness of 100 mg/l as CaCO3. CF=0.85 (CMC).

12. Cyanide

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: Species deletion was conducted based on the toxicity data in the 1995 Updates. Rainbow Trout is the most sensitive species tested to acute toxicity of Cyanide. Thus,

it is kept to protect the Topeka Shiner – the endangered species. The recalculation results in the same criteria as the 304(a) values. Thus, the 304(a) criteria are proposed.

Tables 12a and 12b show the species used in the calculation and the proposed acute and chronic criteria for Cyanide.

Table 12a. Recalculation of **Cyanide** Criteria by Species Deletion

SPECIES					Species Used in Different Stream Designations		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	45	Yes	Yes	Yes
Salvelinus	fontinalis	SALMONIDAE	brook trout	86			
Salmo	salar	SALMONIDAE	atlantic salmon	90			
Perca	flavescens	PERCIDAE	yellow perch	93	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	bluegill	99	Yes	Yes	Yes
Pomoxis	nigromaculatus	CENTRARCHIDAE	black crappie	102	Yes	Yes	Yes
Micropterus	salmoides	CENTRARCHIDAE	largemouth bass	102	Yes	Yes	Yes
Daphnia	magna	DAPHNIDAE	cladoceran	160	Yes	Yes	Yes
Daphnia	pulex	DAPHNIDAE	cladoceran	95.55	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fathead	125.1	Yes	Yes	Yes
Poecilia	reticulata	POECILIIDAE	guppy	147	Yes	Yes	Yes
Gammarus	pseudolimnaeus	GAMMARIDAE	amphipod	167	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	318	Yes	Yes	Yes
Pteronarcys	dorsata	PTERONARCIDAE	stonefly	426	Yes	Yes	Yes
Physa	heterostropha	PHYSIDAE	snail	432	Yes	Yes	Yes
Asellus	communis	ASELLIDAE	isopod	2326	Yes	Yes	Yes
Tanytarsus	dissimilis	CHIRONOMIDAE	midge	2490	Yes	Yes	Yes
			Number of Species, N		14	14	14
			FINAL ACUTE VALUE (ug/l)		43.59	43.59	43.59
			ACUTE/CHRONIC RATIO		8.568	8.568	8.568
			Recalculated CMC ((ug/l)		21.795	21.80	21.80
			FINAL CMC(total)		22*	22*	22*
			Recalculated CCC (ug/l)		5.09	5.09	5.09
			FINAL CCC((ug/l)(total)		5.2*	5.2*	5.2*
			* Adopts the 304(a) criteria				

Protection for Endangered Species: Since the 304(a) criteria were proposed for each designation use, consultation is deferred to the national level.

Table 12b. Current and Proposed IDNR Aquatic Life Criteria for **Cyanide** (total, unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	45	22	45	22	45	22	22
Chronic(CCC)	10	5.2	10	5.2	10	5.2	5.2

13. Pentachlorophenol

EPA issue: When the cold water criteria were recalculated by IDNR in 2000, IDNR did not comply with the eight family rule, further, all Cladocerans were deleted from the database.

DNR Response: Pentachlorophenol is related to Cold Water designations. It will be addressed when the criteria for Cold Water are addressed.

14. Aldrin

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria. There is no 304(a) criterion for chronic aquatic life.

Criteria recalculation: IDNR never adopted numerical criteria for Aldrin. The reason is unknown. The toxicity data on Aldrin in the 304(a) criteria document (US EPA, 1980) is very limited. The 304(a) criteria only contains an acute value of 3 ug/l. No chronic criterion is available. The acute 304(a) criterion is proposed for the three designations in Iowa.

Protection for Endangered Species: Since the 304(a) criteria were proposed for each designation use, consultation is deferred to the national level.

Table 14. Current IDNR and EPA Aquatic Life Criteria for **Aldrin** (unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	N/A	3.0	N/A	3.0	N/A	3.0	3.0
Chronic(CCC)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

15. Chlordane

EPA issue: Criteria for the protection of B(WW-2) (and subsequently B(WW-3) are significantly less stringent than EPA's 304(a) criteria; EPA does not know how IDNR derived their historic criteria.

Criteria clarification:
Class B(WW-1):
The current Iowa criteria for Chlordane and the current EPA 304(a) criteria are shown in Table 18b. The current Iowa criteria for the Class B(WW-1) designations is basically the same as the 304(a) criteria. To be totally consistent with the 304(a) criteria, the acute criterion is changed from 2.5 ug/l to 2.4 ug/l.

Class B(WW-2) & B(WW-3) Acute Criterion:
The acute criterion for Class B(WW-2) and Class B(WW-3) designations are basically the same as the 304(a) criteria. To be totally consistent with the 304(a) criteria, the acute criterion is changed from 2.5 ug/l to 2.4 ug/l.

Class B(WW-2) & B(WW-3) Chronic Criterion:
The chronic criteria for Iowa deviate from the 304(a) chronic criteria for Chlordane. The 304(a) chronic criterion of 0.0043 ug/l was developed as the Final Residue Value based on the FDA action level for edible fish. IDNR did not adopt this chronic value for Class B(LR) Limited Resources designations during the last criteria review based on the reasoning that Class B(LR) waters do not provide fish for human consumption. In the new proposed rule that has been submitted to EPA for approval, Class B(LR) is renamed as Class B(WW-2) Type 2 warm water designation. IDNR proposed the freshwater final chronic value of 0.17 ug/l based on aquatic life protection. EPA's ambient criteria for Chlordane (US EPA, 1980) states that "The Freshwater

Final Acute Value is 2.4 ug/l, the Freshwater Final Chronic Value is 0.17 ug/l, and the Freshwater Final Residue Value is 0.0043 ug/l based on the FDA action level for edible fish."

The Final Residue Value is established to protect the marketability of edible fish, the concentration of Chlordane in edible tissue cannot exceed the action level of 0.3 mg/kg established by the U.S. Food and Drug Administration (FDA) for Chlordane.

EPA no longer recommends the use of Final Residue Value to derive chronic criteria for aquatic life protection since 1995.

Protection for Endangered Species: In Iowa, as required by the Endangered Species Act, the following aquatic dependent species should be protected from consuming fish, bald eagle, least tern, piping plover and Indiana bat. Since there is no 304(a) criteria for wildlife criteria at this time, the Final Residue Value for the protection of fish marketability is proposed as the chronic criteria for all three designations.

Table 15. Current IDNR and EPA Aquatic Life Criteria for **Chlordane** (unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	2.5	2.4	2.5	2.4	2.5	2.4	2.4
Chronic(CCC)	0.004	0.0043	0.15	0.0043	0.15	0.0043	0.0043*

* based on Final Residue Value. The final chronic value is 0.17 ug/l.

16. 4-4'-DDT

EPA Issue - criteria for the protection of WW-2 (and subsequently WW-3) is significantly less stringent than EPA's 304(a) criteria; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation:
Class B(WW-1) Acute Criterion:
The current Iowa criteria for DDT and the current EPA 304(a) criteria are shown in Table 16. The current Iowa criteria for the Class B(WW-1) designations is a little lower than the 304(a) criteria. To be consistent with 304(a) criterion, the 304(a) criterion for acute protection is proposed as the acute value for Class B(WW-1).

Class B(WW-1) Chronic Criterion:
It is the same as the 304(a) chronic criterion. No change is proposed.

Class B(WW-2) & B(WW-3) Acute criterion:
The current Iowa criteria for the Class B(WW-2) and B(WW-3) designations are a little lower than the 304(a) criteria. To be consistent with 304(a) criterion, the 304(a) criterion for acute protection is proposed as the acute value for Class B(WW-1).

Class B(WW-2) & B(WW-3) Chronic Criterion:
The chronic criteria for Class B(WW-2) and B(WW-3) designations deviate from the 304(a) chronic criteria for DDT. The 304(a) chronic criterion of 0.001 ug/l was developed as the Final Residue Value for both freshwater and saltwater using the lowest maximum permissible tissue concentration of 0.15 mg/kg based on reduced productivity of the Brown Pelican. IDNR did not adopt this chronic value for Class B(LR) Limited Resources designations (now Class B(WW-2)

designation) during the last criteria review based on the reasoning that Class B(LR) waters do not provide fish for human consumption.

EPA no longer recommends the use of Final Residue Value to derive chronic criteria for aquatic life protection since 1995.

Protection for Endangered Species: In Iowa, as required by the Endangered Species Act, the following aquatic dependent species should be protected from consuming fish, bald eagle, least tern, piping plover and Indiana bat. Since there are no 304(a) criteria for wildlife criteria at this time, the Final Residue Value for the protection of productivity of the Brown Pelican is proposed as the chronic criteria for all three designations to meet the ESA requirement.

Table 16. Current and Proposed IDNR and EPA Aquatic Life Criteria for **4-4'-DDT** (unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	0.8	1.1	0.95	1.1	0.95	1.1	1.1
Chronic(CCC)	0.001	0.001	0.029	0.001	0.029	0.001	0.001*

* based on Final Residue Value.

17. Endosulfan

EPA issue: the Iowa criteria are outdated; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: The current criteria were recalculated based on species deletion in 1994 by deleting Rainbow Trout for warm water designations. It did not meet the 8 family rule. There are only 10 genus species in the national toxicity dataset. Since adequate toxicity data are not available to conduct species deletion for the recalculation, the 304(a) criteria are proposed for this revision.

Table 17. Current and Proposed IDNR and EPA Aquatic Life Criteria for **Endosulfan** (unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	0.3	0.22	0.3	0.22	0.3	0.22	0.22
Chronic(CCC)	0.15	0.056	0.15	0.056	0.15	0.056	0.056

18. Endrin

EPA issue: When the cold water criteria were recalculated by IDNR in 2000, IDNR did not comply with the eight family rule, further, all Cladocerans were deleted from the database.

IDNR response: Endrin is a cold water criteria issue. The criteria for warm water designations are fine. It will be addressed when the criteria for cold waters are reviewed.

19. Heptachlor and Heptachlor Epoxide

EPA issue for Heptachlor: The criteria for the protection of B(WW-2) (and subsequently B(WW-3) are significantly less stringent than EPA's 304(a) criteria; EPA does not know how IDNR derived their historic criteria.

EPA issue for Heptachlor Epoxide: Iowa never proposed criteria, i.e., it is missing.

Criteria recalculation:

B(WW-1) Acute Criterion:

The Iowa acute criteria for the Class B(WW) designation (now the Class B(WW-1) designation based on the new WQS) was recalculated in 1994 with all the species toxicity data in the national dataset retained. It resulted in an acute value of 0.38 ug/l, which is more stringent than the current 304(a) criterion. Since the recalculated value followed the EPA guidelines for criteria derivation (1985b), no change is proposed.

B(WW-1) Chronic Criterion:

The current chronic criterion is the same as the 304(a) criterion, no change is proposed.

Class B(WW-2) & B(WW-3) Acute Criterion:

The Iowa acute criteria for the Class B(LR) designation (now the Class B(WW-2) designation based on the new WQS) was recalculated in 1994 with all the species toxicity data in the national dataset retained. It resulted in an acute value of 0.38 ug/l, which is more stringent than the current 304(a) criterion. Since the recalculated value followed the EPA guidelines for criteria derivation (1985b), no change is proposed.

Class B(WW-2) & B(WW-3) Chronic Criterion:

The current 304(a) criterion of 0.0038 ug/l for chronic protection was derived based on Final Residue Value for the protection of fish and shellfish marketability. The final residue value of 0.0038 ug/l was calculated by dividing the U.S. Food and Drug Administration (FDA) action level of 0.3 mg/kg edible fish and shellfish by the geometric mean of normalized bioconcentration factor values and by a percent lipid value of 15 for freshwater species based on marketability for human consumption. The FRV based 304(a) chronic criterion was only adopted for Class B(WW) waters not Class B(LR) waters (now Class B(WW-2) designation) during the last criteria review. The old IDNR chronic criterion for Class B(LR) was calculated based on FACR for fathead minnow and it did not follow EPA's requirement on the use of FACR. Since 1995, EPA no longer recommends the use of FRV for deriving chronic criteria.

Species deletion on acute toxicity test data did not result in more relaxed criteria values. Thus, the 304(a) criterion for acute protection is proposed.

Heptachlor Epoxide is a degraded form of Heptachlor. The EPA 304(a) criteria for Heptachlor Epoxide was derived from toxicity data for Heptachlor since the EPA criteria document provides insufficient data to estimate the relative toxicities of Heptachlor and Heptachlor Epoxide. Thus, it is recommended to adopt the same criteria for Heptachlor Epoxide as Heptachlor in Iowa.

Protection for Endangered Species: In Iowa, as required by the Endangered Species Act, the following aquatic dependent species should be protected from consuming fish, bald eagle, least tern, piping plover and Indiana bat. Since there are no 304(a) criteria for wildlife criteria at this time, the Final Residue Value of 0.0038 ug/l for the protection of fish and shellfish marketability for human consumption is proposed as the chronic criteria for all three designations.

Table 19. Current and Proposed IDNR and EPA Aquatic Life Criteria for **Heptachlor & Heptachlor Epoxide** (unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	0.38	0.38	0.38	0.38	0.38	0.38	0.52
Chronic(CCC)	0.0038	0.0038	0.01	0.0038	0.01	0.0038	0.0038*

* based on Final Residue Value.

20. PCB

EPA issue: Criteria for the protection of B(WW-2) (and subsequently B(WW-3) is significantly less stringent than EPA's 304(a) criteria; EPA does not know how IDNR derived their historic criteria.

Criteria recalculation:

Class B(WW-1) Acute Criterion:

The derivation of the old Iowa criteria for PCB is unknown. The examination of the acute toxicity data indicates that there is not adequate data available for conducting species deletion calculations. Even though no 304(a) acute criterion is available, the 304(a) criteria document for PCB (US EPA, 1980) indicates that the acute toxicity to freshwater aquatic life probably will only occur at concentrations above 2 ug/l. Thus, the value of 2 ug/l is proposed as the acute criterion for all three designations.

Class B(WW-1) Chronic Criterion:

The chronic criterion is the same as the 304(a) criterion. No change is proposed.

Class B(WW-2) & B(WW-3) Acute Criterion:

The examination of the acute toxicity data indicates that there is not adequate data available for conducting species deletion calculations. Even though no 304(a) acute criterion is available, the 304(a) criteria document for PCB (US EPA, 1980) indicates that the acute toxicity to freshwater aquatic life probably will only occur at concentrations above 2 ug/l. Thus, the value of 2 ug/l is proposed as the acute criterion for all three designations.

Class B(WW-2) & B(WW-3) Chronic Criterion:

For chronic protection, the Final Chronic Value is derived using FACR of 8.39, which is the geometric mean of the FACR for fathead minnow (6.4) and Scud (11). Thus, the Final Chronic Value is 0.25 ug/l. However, the current EPA chronic criterion of 0.014 ug/l was based on FRV for wildlife protection. The FRV value of 0.014 ug/l is derived as follows. For wildlife protection, the lowest maximum permissible tissue concentration is 0.64 mg/kg for mink. Dividing this value by the geometric mean of whole-body bioconcentration factor values for Salmonids gives a residual value for freshwater of 0.014 ug/l. Since 1995, EPA no longer recommends the use of FRV for deriving chronic criteria.

Protection for Endangered Species: In Iowa, as required by the Endangered Species Act, the following aquatic dependent species should be protected from consuming fish, bald eagle, least tern, piping plover and Indiana bat. Since there is no 304(a) criteria for wildlife criteria at this time, the Final Residue Value of 0.014 ug/l for the protection of wildlife is proposed as the chronic criteria for all three designations.

Table 20. Current and Proposed IDNR and EPA Aquatic Life Criteria for **PCB** (unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	2	2	2	2	2	2	
Chronic(CCC)	0.014	0.014	1	0.014	1	0.014	0.014*

* based on Final Residue Value.

21. Toxaphene

EPA issue: Toxaphene – Although IDNR conducted a species recalculation for the chronic Toxaphene criteria in 2000, it is not clear where IDNR came up with their toxicity data to perform this recalculation. EPA's 1986 Criteria document for Toxaphene states on page 12:

"The available data on freshwater acute-chronic ratios do not allow calculation of a freshwater final chronic value, but if one could be calculated it would have to be less than the 0.039 ug/L that adversely affected brook trout in a particular life-cycle test."

IDNR adopted the chronic value of 0.037 ug/L for Toxaphene, which is close enough to the value cited in the criteria document as potentially causing adverse affects. The toxicity data used to derive 0.037 ug/L chronic criteria needs to be identified.

Criteria recalculation: The current 304(a) criteria are as follows: the acute criterion (or final acute value) is 0.73 ug/l, and the chronic criterion (final chronic value) is 0.039 ug/l to protect the Brook Trout. The Final Residue Value (FRV) is 0.0002 ug/l and is derived based on field data to protect Lake Trout in the Great Lakes not exceeding the FDA action level of 5 mg/kg Toxaphene concentration. For the criteria recalculation, IDNR proposes the CMC as the acute criteria for aquatic life protection, and the CCC as the chronic criterion for aquatic life protection.

Protection for Endangered Species: In Iowa, as required by the Endangered Species Act, the following aquatic dependent species should be protected from consuming fish, bald eagle, least tern, piping plover and Indiana bat. Since there are no 304(a) criteria for wildlife criteria at this time, the Final Residue Value of 0.002 ug/l based on FDA action level for edible fish or shellfish of 5 mg/kg is proposed as the chronic criteria for all three designations. It is important to note that the FRV should be 0.002 ug/l not 0.0002 ug/l as published in the 304(a) criterion. There is a decimal point error in the published 304(a) criterion for FRV.

Table 21. Current and Proposed IDNR and EPA Aquatic Life Criteria for **Toxaphene** (unit in μg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Chronic(CCC)	0.037	0.002	0.037	0.002	0.037	0.002	0.0002*

* based on Final Residue Value (the value should be 0.002 ug/l, there is a decimal error in EPA 304(a) criteria document).

22. Chlorine

EPA issue: EPA does not know how IDNR derived their historic criteria.

Criteria recalculation: The criteria are recalculated to meet the 8 family rule and *Daphnia spp.* are kept in the recalculation for all warm water designations. The species deletion did not result

in less stringent criteria. The 304(a) criteria are proposed. Tables 22a and 22b show what species are used in the recalculation and the proposed new criteria for Chlorine.

Table 22a. Recalculation of **Chlorine** Criteria by Species Deletion

SPECIES					Species Used in Different Stream Designations		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Daphnia	magna	DAPHNIDAE	cladoceran	27.66	Yes	Yes	Yes
Epischura	lacustris	TEMORIDAE	copepod	63	Yes	Yes	Yes
Goniobasis	virginica	PLEUROCERIDAE	snail	69.57	Yes	Yes	Yes
Oncorhynchus	clarki	SALMONIDAE	cutthroat trout	85.46			
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	61.92	Yes	Yes	Yes
Notropis	anogenus	CYPRINIDAE	pugnose shiner	45	Yes	Yes	Yes
Notropis	cornutus	CYPRINIDAE	common shiner	51	Yes	Yes	Yes
Notropis	lutrensis	CYPRINIDAE	red shiner	169	yes	yes	yes
Oncorhynchus	kisutch	SALMONIDAE	coho salmon	74.79			
Cyclops	bicuspidatus	CYCLOPIDAE	copepod	76.13	Yes	Yes	Yes
Nitocris	carinata	PLEUROCERIDAE	snail	79.86	Yes	Yes	Yes
Salvelinus	fontinalis	SALMONIDAE	brook trout	117.4			
Salvelinus	namaycush	SALMONIDAE	lake trout	60			
Ictalurus	punctatus	ICTALURIDAE	channel catfish	90	Yes	Yes	Yes
Stenonema	ithaca	HEPTAGENIIDAE	mayfly	102	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fathead minnow	105.2	Yes	Yes	Yes
Notemigonus	crysoleucas	CYPRINIDAE	golden shiner	127	Yes	Yes	Yes
Pomoxis	sp.	CENTRARCHIDAE	crappie	127	Yes	Yes	Yes
Stizostedion	vitreum	PERCIDAE	walleye	127.3	Yes	Yes	Yes
Catostomus	commersoni	CATOSTOMIDAE	white sucker	138	Yes	Yes	Yes
Caecidotea	bicrenata	ASELLIDAE	isopod	147.5	Yes	Yes	Yes
Lirceus	alabamae	ASELLIDAE	isopod	150	Yes	Yes	Yes
Perca	flavescens	PERCIDAE	yellow perch	205	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	224	Yes	Yes	yes
Physa	heterostropha	PHYSIDAE	snail	238.8	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	bluegill	245.8	Yes	Yes	Yes
Lepomis	sp.	CENTRARCHIDAE	sunfish	232.8	Yes	Yes	yes
Gammarus	pseudolimnaeus	GAMMARIDAE	amphipod	266.4	Yes	Yes	Yes
Micropterus	salmoides	CENTRARCHIDAE	largemouth bass	266.6	Yes	Yes	Yes
Etheostoma	spectabile	PERCIDAE	darter	390	Yes	Yes	Yes
Pteronarcys	sp.	PTERONARCIDAE	stonefly	400	Yes	Yes	Yes
Orconectes	nais	ASTACIDAE	crayfish	673.1	Yes	Yes	Yes
Gasterosteus	aculeatus	GASTEROSTEIDAE	stickleback	710	Yes	Yes	Yes
			Number of Species, N		26	26	26
			FINAL ACUTE VALUE (ug/l)		36.054	36.054	36.054
			ACUTE/CHRONIC RATIO		3.345	3.345	3.345
			Recalculated CMC ((ug/l)		18.03	18.03	18.03
			FINAL CMC*(total)		19.00	19.00	19.00
			Recalculated CCC (ug/l)		10.78	10.78	10.78
			FINAL CCC*((ug/l)(total)		11	11	11

Protection for Endangered Species: Since the 304(a) criteria were proposed for each designation use, consultation is deferred to the national level.

Table 22b. Current and Proposed IDNR and EPA Aquatic Life Criteria for **Chlorine** (unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	35	19	40	19	40	19	19
Chronic(CCC)	20	11	25	11	25	11	11

23. Lindane

EPA issue: Not sure what the issues are.

Criteria recalculation: The criteria are recalculated to meet the 8 family rule and *Daphnia spp.* are kept in the recalculation for all warm water designations. Tables 23a and 23b show what species are used in the recalculation. The criteria based on the recalculation are the same as the current criteria. They are also the same as the current 304(a) criteria. No changes are recommended.

Table 23a. Recalculation of **Lindane** Criteria by Species Deletion

SPECIES					Species Used in Different Stream Designations		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW2)	B(WW-3)
Pteronarcys	californicus	PTERONARCIDAE	Stonefly	2.1	Yes	Yes	Yes
Notonecta	undulata	NOTONECTIDAE	Backswimmer	3	Yes	Yes	Yes
Lymnaea	stagnalis	LYMNAEIDAE	Snail	3.3	Yes	Yes	Yes
Asellus	brevicaudus	ASELLIDAE	Isopod	10	Yes	Yes	Yes
Salmo	trutta	SALMONIDAE	brown trout	13			
Peltodytes	sp.	HALIPLIDAE	Crawling water beetle	20	Yes	Yes	Yes
Lestes	congener	COENAGRIONIDAE	damselfly	20	Yes	Yes	Yes
Gammarus	fasciatus	GAMMARIDAE	Amphipod	10.49	Yes	Yes	Yes
Gammarus	lacustris	GAMMARIDAE	Amphipod	65	Yes	Yes	Yes
Micropterus	salmoides	CENTRARCHIDAE	largemouth bass	32	Yes	Yes	Yes
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	26	Yes	Yes	Yes
Oncorhynchus	tshawytscha	SALMONIDAE	chinook salmon	36			
Oncorhynchus	kisutch	SALMONIDAE	coho salmon	40			
Salvelinus	fontinalis	SALMONIDAE	brook trout	44			
Salvelinus	namaycush	SALMONIDAE	Lake Trout	28			
Perca	flavescens	PERCIDAE	yellow perch	40	Yes	Yes	Yes
Ictalurus	punctatus	ICTALURIDAE	channel catfish	46	Yes	Yes	Yes
Ictalurus	melas	ICTALURIDAE	black bullhead	64	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	bluegill	56	Yes	Yes	Yes
Lepomis	microlophus	CENTRARCHIDAE	redear sunfish	83	Yes	Yes	Yes
Lepomis	cyanellus	CENTRARCHIDAE	Green sunfish	76	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fathead	72	Yes	Yes	Yes
Cyprinus	carpio	CYPRINIDAE	carp	90	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	117	Yes	Yes	Yes
Poecilia	reticulata	POECILIIDAE	guppy	138	Yes	Yes	Yes
Chironomus	tentans	CHIRONOMIDAE	midge	207	Yes	Yes	Yes
Daphnia	pulex	DAPHNIDAE	cladoceran	460	Yes	Yes	Yes

Daphnia	magna	DAPHNIDAE	cladoceran	630	Yes	Yes	Yes
Simocephalus	serrulatus	DAPHNIDAE	cladoceran	676	Yes		
Pseudacris	triseriata	HALIDAE	Western chorus frog	2650	Yes	Yes	Yes
Bufo woodhousi	fowleri	BUFONIDAE	Fowlers toad	3200	Yes	Yes	Yes
			Number of Species, N		21	20	20
			FINAL ACUTE VALUE (ug/l)		1.769	1.703	1.703
			ACUTE/CHRONIC RATIO		N/A	N/A	N/A
			Recalculated CMC ((ug/l)		0.8845	0.8515	0.8515
			FINAL CMC*(total)		0.95	0.95	0.95
			Recalculated CCC (ug/l)		N/A	N/A	N/A
			FINAL CCC*((ug/l)(total)		N/A	N/A	N/A
			* The values are the same as the current Iowa acute criteria				

Protection for Endangered Species: Since the 304(a) criteria were adopted for each designation use, consultation is deferred to the national level.

Table 23b. Current and Proposed IDNR and EPA Aquatic Life Criteria for **Lindane** (unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Chronic(CCC)	N/A	N/A	N/A	N/A	N/A	N/A	

24. Dieldrin

EPA issue: Not sure what the issues are.

Criteria recalculation: The criteria are recalculated to meet the 8 family rule and *Daphnia spp.* are kept in the recalculation for all warm water designations. Tables 24a and 24b show what species are used in the recalculation. The criteria based on the recalculation are the same as the current criteria. They are also the same as the current 304(a) criteria. No changes are recommended.

Table 24a. Recalculation of **Dieldrin** Criteria by Species Deletion

SPECIES					Species Used in Different Stream Designations		
GENUS	SPECIES	FAMILY	COMMON	SMAV	B(WW-1)	B(WW-2)	B(WW-3)
Pteronarcella	badia	PTERONARCIDAE	Stonefly	0.5			
Pteronarcys	californica	PTERONARCIDAE	stonefly	0.5	Yes	Yes	Yes
claassenia	sabulosa	PERLIDAE	Stonefly	0.6	Yes	Yes	Yes
Oncorhynchus	kisutch	SALMONIDAE	coho salmon	10.8			
Oncorhynchus	tshawytscha	SALMONIDAE	chinook salmon	6.1			
Oncorhynchus	clarki	SALMONIDAE	Cutthroat trout	6			
Oncorhynchus	mykiss	SALMONIDAE	rainbow trout	0.62	Yes	Yes	Yes
Micropterus	salmoides	PEERCICHTHYIDAE	Largemouth bass	3.5	Yes	Yes	Yes
Poecilia	reticulata	POECILIIDAE	guppy	4.5	Yes	Yes	Yes
Ictalurus	punctatus	ICTALURIDAE	Channel catfish	4.5	Yes	Yes	Yes
Asellus	brevicaudus	ASELLIDAE	isopod	5	Yes	Yes	Yes
Lepomis	macrochirus	CENTRARCHIDAE	Bluegill	11.5	Yes	Yes	Yes
Lepomis	gibbosus	CENTRARCHIDAE	Pumpkinseed	6.7	Yes	Yes	Yes

Lepomis	cyanellus	CENTRARCHIDAE	Green Sunfish	8.1	Yes	Yes	Yes
Carassius	auratus	CYPRINIDAE	goldfish	8.6	Yes	Yes	Yes
Ischnura	verticalis	COENAGRIONIDAE	damselfly	12	Yes	Yes	Yes
Pimephales	promelas	CYPRINIDAE	fathead	17.7	Yes	Yes	Yes
Palaemonetes	kadiakensis	PALAEMONIDAE	glass shrimp	20	Yes	Yes	Yes
Lumbriculus	variegatus	LUMBRICULIDAE	annelid	21.8	Yes	Yes	Yes
Simocephalus	serrulatus	DAPHNIDAE	cladoceran	214	Yes		
Daphnia	pulex	DAPHNIDAE	cladoceran	228	Yes	Yes	Yes
Gammarus	fasciatus	GAMMARIDAE	Amphipod	620	Yes	Yes	Yes
Gammarus	lacustris	GAMMARIDAE	Amphipod	460	Yes	Yes	Yes
Orconectes	nais	ASTACIDAE	crayfish	740	Yes	Yes	Yes
				Number of Species, N	17	16	16
				FINAL ACUTE VALUE (ug/l)	0.259	1.703	1.703
				ACUTE/CHRONIC RATIO	8.53	8.53	8.53
				Recalculated CMC ((ug/l)	0.1295	0.8515	0.8515
				FINAL CMC*(total)	0.24	0.24	0.24
				Recalculated CCC (ug/l)	0.030	0.1996	0.1996
				FINAL CCC*((ug/l)(total)	0.056	0.056	0.056
			* 304(a) criteria				

Protection for Endangered Species: Since the 304(a) criteria were adopted for each designation use, consultation is deferred to the national level.

Table 24b. Current and Proposed IDNR and EPA Aquatic Life Criteria for **Dieldrin** (unit in µg/l)

Criteria	Class B(WW-1)		Class B(WW-2)		Class B(WW-3)		EPA Criteria
	Current	Proposed	Current	Proposed	Current	Proposed	Current
Acute(CMC)	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Chronic(CCC)	0.056	0.056	0.056	0.056	0.056	0.056	0.056

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Appendix A:

Literature Review on Cladocera for Criteria Recalculation

Literature Review on Cladocera for Criteria Recalculation

There has been a constant debate on the issue of Cladocera as a resident species in streams in Iowa over the years. In the previous site specific criteria development for Iowa during the late 80's and early 90's, EPA Region 7 staff helped Iowa to develop the site specific criteria. At that time, all Cladocera species were deleted from the national toxicity database during the criteria recalculation process for streams. Some Cladocera species were kept for lakes criteria development. The deletion of Cladocera for stream criteria was justified in an EPA document by Norman Crisp (1985), who stated the following:

"In general, the zooplankton community in rivers and streams is dominated by rotifers. The Copepoda and Cladocera, when present, are generally the result of releases from upstream or tributary lakes and/or impoundments. Both of these groups are quickly lost, often at rates of 1 to 3 percent per kilometer. The infrequency of occurrence of the families Daphanidae and Cyclopidae, the primary zooplankton families in the toxicity data base, in river and stream environments is illustrated by data from the Cedar River in Iowa where the family Daphnidae accounted for 0.3% and the family Cyclopidae accounted for 0.06% of the total zooplankton community."

For this criteria recalculation, IDNR conducted a thorough literature and data search on the occurrence of Cladocera, especially *Daphnia spp*. and *Ceriodaphnia spp.* The literature review and data search indicate that *Ceriodaphnia* are a resident species in lakes, backwaters of large rivers and large impoundments. *Daphnia spp*. also prefers similar habitats. However, *Daphnia spp.* may also be present in interior streams based on data collected in the literatures and IDNR Education web site information (IDNR, 2006). As a result, for the criteria recalculation, the *Daphnia spp*. is kept in the toxicity database for all three Class B designations B(WW-1), B(WW-2) and B(WW-3), and *Ceriodaphnia spp*. are only kept for Class B(WW-1) designation. The following section supports and justifies the IDNR approach on Cladocera, specifically the deletion of *Ceriodaphnia spp.* for Class B(WW-2) and B(WW-3) streams.

I. Expert Opinions

IDNR contacted several leading experts in ecology and aquatic toxicity at the Iowa State University. Dr. Gary J. Atchison, Emeritus University Professor, Department of Natural Resource Ecology & Management, Iowa State University, Ames, Iowa provided the following expert opinion regarding Cladocera (e-mail 10/3/2006):

"I don't think you would expect to find these animals in most of Iowa streams, at least not resident. They would occupy backwater, static areas along our larger rivers, but not in the flowing portions of streams unless they have been washed out of reservoirs or backwaters. If any are found, it would most likely be D. pulex, as I don't think D. magna is even found to any extent in our lakes. I think there is a difference between being present and being resident, although I don't know how regulatory agencies would look at that. Cladocerans may be present on occasion, but probably not resident."

Also, Dr. Joseph E. Morris, Department of Natural Resource Ecology & Management, Iowa State University, Ames, Iowa provided the following expert opinion (e-mail 10/3/2006):

"Typically small streams would have aquatic insects such as stoneflies and mayflies and not cladoceran species. I have found Daphnia spp in streams that drain out of a reservoir or large rivers that have backwater standing water areas. In general, you might find some rotifers and

copepods in these streams depending on flow rates. However, the main taxa still are probably insecta."

Based on these expert opinions, Cladocera may be present but are not resident species in streams. *Daphnia spp.* (only *Daphnia pulex*) may be present in the backwaters of large streams. This information supports the IDNR approach in the recalculation. *Daphnia spp.* is kept in the toxicity database for all three designations, Class B(WW-1), B(WW-2) and B(WW-3). *Ceriodaphnia spp.* is kept for Class B(WW-1) designations. The IDNR approach is more protective than the expert opinions since both *Ceriodaphnia spp.* and *Daphnia spp.* are kept for Class B(WW-1) designation. All *Daphnia spp.* (not just *Daphnia pulex*) are kept for all three Class B warm water designations.

II. Research papers by Midwest Expert (Dr. James Thorp, Senior Scientist Kansas Biological Survey)

EPA Region 7 provided IDNR several research papers by Dr. James Thorp. IDNR staff reviewed all the information. IDNR staff conclusion is that these studies are on large rivers such as the St. Lawrence River and Ohio River. The information does not support the theory that *Ceriodaphnia spp*. reside in small wadable streams. IDNR staff also talked to Dr. Thorp on October 30, 2006. Dr. Thorp indicated he only studied large streams and he is not sure whether Cladocera occur in small wadable streams. The following summarizes the contents of each research paper written by Dr. Thorp.

Paper #1: Potential effects on zooplankton from species shifts in planktivorous mussels: a field experiment in the St Lawrence River, 2002. Freshwater Biolog, vol. 47, 107-119.

The paper studied the potential impact on zooplankton, specifically Rotifers and Copepods between native Unionid Mussels and invading Dreissenid Mussels in the St. Lawrence River, which originates primarily from a large lentic ecosystem, with about 50% of its discharge contributed by Lake Ontario. No discussions are on Cladocera.

Paper#2: Importance of Biotic Interactions in Large Rivers: An Experiment with Planktivorous Fish, Dreissenid Mussels and Zooplankton in the St Lawrence River. 2003. River Res. Applic., Vol. 19: 265-279.

The paper discussed how Yellow Perch and Dreissenid Mussels affect zooplankton populations in a slackwater area of the St Lawrence River (stream order, 8). The zooplanktion studied include Rotifers, Copepod and Cladocera. Nearly 100% of the Cladocera collected in the experiment were *Bosmina spp*. The study found the densities of rotifers *Synchaeta* and *Bosmina spp*. increased when perch were present. Densities of eight of ten zooplankton groups declined significantly when mussels were present. The study was on the backwaters of a large river, the St. Lawrence River.

Paper#3: Impacts of fish predation on an Ohio River zooplankton community. 2003. Journal of Plankton Research, Vol. 24, No. 2, 19-127.

The paper discussed the response of zooplankton to increasing biomass of fish in a large river environment, the Ohio River (stream order, 9). The population growth rates of the most common zooplankton, *Diacyclops thomasi* (Copepod) varied inversely with fish biomass. The reverse pattern was seen for the rotifer *Polyarthra spp*. Other crustacean zooplankton such as *Bosmina* and *Diaphanosoma* (Cladocera) showed no significant response to fish treatment. As stated in the paper, the zooplankton communities of many rivers are dominated by rotifers and small-

bodied crustacean zooplankton, such as *Bosmina*, and zooplankton densities in the rivers are often lower than those commonly seen in lakes (Pace et al., 1992; Thorp et al., 1994).

Paper#4: Effects of the benthic suspension feeder Dreissena polymorpha on zooplankton *in a large river. 2000. Freshwater Biology, vol. 44, 569-579.*

The paper discussed the Zebra Mussels' negative impacts on zooplankton in a large river, the Ohio River. The zooplanktons collected are almost the same as that in paper #3 and include Rotifers, Copepod and Cladocera (*Bomina* and *Diaphanosoma*).

Paper#5: Thorp, James. H. and S. Mantovani. Zooplankton of turbid and hydrologically dynamic prairie rivers. 2005. Freshwater Biology, vol. 50, 1474-1491.

Comparing with other research papers that are looking solely at large rivers, this paper addresses relatively smaller prairie streams (stream order ranges from 4 to 7). It examined summer zooplankton distribution in five prairie rivers (Arkansas, Kansas, Platte, Elkhorn, and Niobrara Rivers) spread over six degrees of latitude during 2003-2004. The study shows microcrustaceans (Copepods and a few Cladocera) were present in all prairie rivers, but each river was dominated very strongly by rotifers. In fact, rotifers constituted on average 99.46% of the zooplankton in the five rivers. Among the few Cladocera collected in the five prairie streams, neither *Daphnia spp.* nor *Ceriodaphnia spp*. were found (*Bosmina, Diaphanosoma, Sida* were collected in some but not all rivers). This paper stated both *Daphnia spp.* and *Ceriodaphnia* were found in the backwaters of the large rivers, the Ohio and St. Lawrence Rivers in the previous studies. However, they were not found in the five prairie streams. Two reasons could contribute to the dominance of rotifers in these prairie streams. The first reason is that the rivers (some with ephemeral sandbars) do not provide sufficient hydrological retention in time and space to sustain many if any viable populations of microcrustaceans but that they are adequate to help sustain growth of rotifer populations. This is consistent with conclusions of other scientists that rotifers require shorter water retention times in rivers for somatic and reproductive growth than do microcrustaceans (Pace et al., 1992; Kobayashi, 1997). The second reason is that high turbidity reduces population growth rates of cladocera much more than it affects rotifers.

III. Research Papers on Topeka Shiner Diet

Dr. Hatch and graduate students have reported on the volumetric contribution of the Cladoceran genera to the seasonal diet of Topeka Shiners in the Rock River watershed which lies within Minnesota and Iowa.

Citations:

Hatch, Jay H. and Shawn Besaw. 2001. Food Use in Minnesota Populations of the Topeka Shiner (Notropis topeka). Journal of Freshwater Ecology, vol. 16 (2) 229-234.

Dahle, Shawn Patrick. 2001. Studies of Topeka shiner (Notropis topeka) Life History and Distribution in Minnesota. A Thesis submitted to the Faculty of the Graduate School of the University of Minnesota.

IDNR staff reviewed both documents. Dr. Hatch's paper studied four streams, Mound Creek, Little Rock River, Elk Creek, and Rock River in Minnesota. Among the four streams, Cladocera were only found in Mound Creek. Cladocera were not found in any of the other three headwater streams in the study. IDNR staff talked to Dr. Hatch on October 26, 2006 about his research paper. According to Dr. Hatch, there is a reservoir on Mound Creek built for fishing and recreational use since there is a state park next to Mound Creek (see attached map for Mound

Creek). The reservoir/large impoundment are also described in Shawn Dahle's thesis (2001) for Mound Creek.

Furthermore, for the Topeka Shiner diet study described in Dahle's thesis (2001), Topeka Shiners were sampled at three sites within the Big Sioux and Rock watersheds of southwestern Minnesota. They are Mound Creek, Beaver Creek and a farm pond (a closed-basin system). The study shows that *Ceriodaphnia* was only found in the guts of Topeka Shiners that were collected in the farm pond and Mound Creek. *Ceriodaphnia* was not found in the guts of Topeka Shiners that were collected in Beaver Creek, another headwater stream in the study. As described in Dahle's thesis, the study site on Mound Creek is located directly downstream of a large impoundment/reservoir (at a state park), where microcrustaceans were surely plentiful.

IV. Species Occurring at the Site

There is a need to differentiate between "resident species" and "present species". Certain species of Cladocera including *Ceriodaphnia spp*. may be present occasionally in a flowing stream (literature search indicates they were found in the backwaters of large rivers and reservoirs), but they are not resident species in main channel of a stream since they are not usually present and reproduce in a lotic environment. As Hutchinson (1967) pointed out in the *Daphniidae* the members of *Ceriodaphnia* prefer pond environment. The literature and data search conducted by IDNR staff indicates Ceriodaphnia were only found in the backwaters of large rivers and they usually do not occur in small wadable streams. US EPA WQS Handbook (1994) defines the phrase "occur at the site" as including the species, genera, families, orders, classes, and phyla that:

- are usually present,
- are present at the site only seasonally due to migration,
- are intermittently present because they periodically return to or extend their ranges into the site,
- were present at the site in the past, are not currently present at the site due to degraded conditions, and are expected to return to the site when conditions improve,
- are present in nearby bodies of water, are not currently present at the site due to degraded conditions, and are expected to be present at the site when conditions improve.

For example, carp may be occasionally found in cold water streams, but they are not resident species or occur in cold water streams.

V. Conclusions

The literature review indicates that no *Ceriodaphnia spp*. was found in either headwater streams or prairie rivers even though other genus of Cladocera such as *Daphnia spp*., *Bosmina spp*. and *Diaphanosoma spp*. were found. *Bosmina spp*. and *Disphanosoma spp.* are not commonly tested species in the national toxicity database. In the criteria recalculation procedure, IDNR included all *Daphnia spp.* for all three warm water designations, Class B(WW-1), B(WW-2) and B(WW-3), and kept *Ceriodaphnia spp*. for Class B(WW-1) use designation since the literature search indicates that relatively abundant *Daphnia spp.* were found in different stream orders, but *ceriodaphnia spp*. were not found. The literature review supports the IDNR recalculation approach.

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Attachment 1:
IDNR bioassessment data on fish and invertebrates (1994-2004)

Attachment 2:
Fish and invertebrates taxa found in the CPCB's USEPA Region 7 fish database

Attachment 3:
Iowa Total Species List compiled by IDNR in 2000

Attachment 4:
Iowa State University Lakes Study data on Zooplankton (2000-2005)